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DIFFERENTIAL HOME ENVIRONMENTS AND MENTAL
ABILITY PATTERNS

BY



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A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Differential Home Environments and Mental Ability Patterns" submitted by Harry Mosychuk in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

ABSTRACT

The principal intentions of this study were to develop an instrument for identifying and measuring the home environment differentially in terms of dynamic process characteristics or psychological presses, and to examine the relationships between such environmental variables and different mental abilities.

The subjects for the study, representing the full socio-economic range in a large urban setting (500,000), consisted of 100 English speaking homes who had a Grade 4 boy. The 100 mothers from these families were interviewed with the Differential Environmental Process Variables (DEPVAR) Interview Schedule which was developed for this study to obtain the environment measures, whereas the 100 respective boys were administered the WISC (Wechsler Intelligence Scale for Children) for the different mental ability scores. The sample of 100 was then divided into two matched groups of 50 each to carry through a full replication within this study for all the analyses.

That the DEPVAR measured home environments differentially was shown by (a) the replicated low intervariable correlations, (b) a greatly reduced first factor unrotated variance contribution (40-50 per cent compared to 75-80 per cent in other studies), and (c) the replicated rotated factors which could be meaningfully interpreted.

The replication of the DEPVAR variable intercorrelations,

and the factor analysis solutions pointed to the consistency of the instrument in measuring environments in different groups. Inter-rater correlation coefficients ranging from 0.817 to 0.917 confirmed the scoring reliability of the DEPVAR scale.

Examining the validity of the DEPVAR in terms of the relationships of these measures with different abilities, first according to established theories and finally with respect to the tested hypotheses in this study, we found that DEPVAR Variables 1, 2, 3, 5, 7, and 8 (Academic and Vocational Aspirations and Expectations of Parents; Knowledge of, and Interest In, Child's Academic and Intellectual Development; Material and Organizational Opportunities for the Use and Development of Language; Female Dominance in Child Rearing; Dependency Fostering-Overprotection; and Authoritarian Home) can be considered with confidence to be valid measures, Variable 4 (Quality of Language in the Home) with limited confidence, while Variables 6, 9, and 10 (Planfulness, Purposefulness, and Harmony in the Home; Interaction with Physical Environment (Visual and Kinaesthetic Experiences); Opportunity for, and Emphasis on, Initiating and Carrying Through Tasks) require re-examination.

The study showed that the environmental characteristics represented by DEPVAR Variables 1, 2, and 3 produced the highest relationships with verbal as well as overall academic types of abilities. The quality of language in the

home (DEPVAR 4), based on the mother's speech, related to verbal abilities in one group but the results did not replicate in the other group. Home environment characteristics such as female dominance (DEPVAR 5), dependency fostering behavior and overprotection (DEPVAR 7) and authoritarianism (DEPVAR 8) showed negative or zero relationships with essentially all types of mental abilities. Furthermore in most cases these environmental characteristics related most negatively to reasoning abilities and WISC Performance IQ. Although the DEPVAR Variables 6, 9, and 10 were hypothesized to relate higher with spatial, perceptual, and reasoning types of abilities than with verbal ones, the results of the study showed that they related best with verbal and overall abilities. There were a few correlations involving these three variables (DEPVAR 6, 9, and 10) that supported the hypothesis however replication was lacking.

In working with the High and Low socio-economic samples, results of this study indicated that scores on the 10 DEPVAR variables, all compared simultaneously, differed significantly for the two socio-economic samples. A posteriori individual comparisons indicated that DEPVAR Variables 1 and 3 (Academic and Vocational Aspirations and Expectations of Parents; Material and Organizational Opportunities for the Use and Development of Language) might contribute most to these overall significant differences.

The DEPVAR variables which did not seem to contribute to the overall differences can be assumed to be environmental measures quite independent of the socio-economic scores.

The results for investigating differences in relationships, for the two socio-economic samples, between DEPVAR variable and factor scores, and WISC Full Scale IQ indicated, with replication, that the correlations between dependency fostering-overprotection characteristics (DEPVAR 7) and authoritarian features (DEPVAR 8), and Full Scale IQ were different for the High socio-economic sample than for the Low one. Substantial differences between the two socio-economic samples occurred for seven of the other DEPVAR variables, however, there was no replication. That is, the differences were not in the same direction for the two samples.

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CHAPTER I

INTRODUCTION AND STATEMENT OF PROBLEM

Despite the two schools of thought it is generally agreed now that intellectual performance is the result of both heredity and environment. Anastasi (1958a) stated that there is heredity which is the genetic contribution, and pre-natal as well as post-natal environment. Most studies consider only the post-natal influence as the environmental component. The effect of the two variables, heredity and environment, is presumed to be interactive or interdependent. This implies that, the same environmental characteristics may have different effects on different genotypes, or that the same type of mental ability may result from different elements interacting with different genotypes. Wolf (1964a) went further and stated that there may be a specific set of environmental processes or a unique set of forces for each individual.

Having established that a person's environment is one of the completely necessary antecedents for his intellectual development, numerous studies have been performed with the purpose of identifying and measuring environments. Until recently most of the research was directed at measuring and identifying global environmental aspects similar to those yielding socio-economic status indices. These measures were based on static and material

elements such as occupation, income, or type of residence. By measuring the environments globally a great amount of information was lost or hidden just as in the case of measuring only general intelligence. Thus it was difficult to establish the exact factors in these environments that were critically related to mental ability.

Van Alstyne (1929; as described in Wellman, 1940a; and Stoddard and Wellman, 1940), Skodak (1939; as described in Skeels, 1940; and in Tyler, 1965), and more recently Fraser (1959) and Douglas (1964), although not measuring at the atomistic level, attempted to move away from evaluating the environment in terms of just good or bad on the basis of the conventional socio-economic characteristics. They included, with some socio-economic aspects, a variety of dynamic process characteristics in the home. They then related these composite measures to mental ability and achievement. Wolf (1964b) identified his home environment in terms of process variables which described what parents do rather than what they are. His environmental process variables related to dynamic characteristics of the home situation including parent-child interactions rather than to the static characteristics such as material possessions or father's occupation. Wolf's environmental scores showed much higher relationships with mental ability than any socio-economic indices did in previous studies. Douglas (1964) also made the point that, during the

formative years of the child, it is the mother's behavior that is of utmost importance. Most socio-economic indices, especially those based on the father's occupation, by and large disregard the mother.

A logical progression in the area of identifying and measuring environments would be an attempt to measure differential home environment variables to determine which variables seem particularly suited for the development of particular intellectual characteristics. Anastasi (1966) says that environments are not just good or bad per se but that particular environments may be suitable for the development of particular intellectual traits. Support for this statement comes from studies by Vernon (1965a), Bernstein (1961), Bing (1963), and Milner (1951). Fifer (1964) postulated that homes with similar environmental structures produce particular factorial ability patterns regardless of socio-economic status or mental ability level.

Wolf's (1964a) environmental measure consisted of three environmental process variables which were composites of thirteen environmental characteristics. He correlated these measures with overall intelligence test scores and obtained coefficients ranging from .568 to .690. Dyer (1967), working with a Trinidadian sample of eleven year old boys and girls, used six environmental process variables which, by a factor analysis procedure, were reduced to one factor. His total Index of Educational

Environment correlated .78 and .67 with achievement, .51 and .32 with non-verbal intelligence and .39 and .11 with verbal intelligence for samples 1 and 2 respectively. It would appear that there is a substantial discrepancy in Wolf's and Dyer's relationships between environment and intelligence scores. Although both researchers used dynamic process characteristics to measure the environments, neither scale seemed to differentiate among different aspects of the environment.

Vernon's (1965b) environmental assessment included the conventional socio-economic characteristics as well as dynamic process elements in the home. He treated the nine environmental variables differentially and correlated them with differential mental ability factors. MacArthur's (1967) factor analysis of Vernon's environmental data indicated that Vernon's scale for measuring environmental elements may be a differential one when used in a cross-cultural setting. [A differential scale is one that measures a number of different aspects of the environment as opposed to one that provides a single global measure.]

With the above studies in mind this project was designed to identify and measure, using dynamic process variables, the various aspects of the home environment and relate these to the development of differential mental abilities. Particularly, rather than measuring one environmental characteristic at a time, this study attempted

to measure the effects of the home environment when the different environmental variables were operating together. Home environment patterns as well as specific environmental process variables were examined in terms of their relationships to mental ability patterns or, specific ability factors or scores. These relationships were investigated with ten year old boys for a broad range of intelligence and socio-economic status in an urban setting.

It is anticipated that this study will contribute to educational knowledge through the development of an instrument which will assist in identifying and measuring, in terms of environmental process variables, the differential aspects of what is probably the most significant influence in the development of human characteristics, the early home environment. Furthermore, being able to measure environments differentially should lead to a more accurate identification of specific environments or environmental patterns that are most suitable for the development of different characteristics in people.

The study will have some further practical implications. Compensatory conditions could be arranged in cases where weaknesses exist or where one wishes to develop particular human characteristics more fully. Early knowledge of home environment conditions may facilitate better placement of students in school programs. A better understanding of the environmental processes in the home may

lead to a fuller comprehension of the interdependence relationship of heredity and environment for the development of any human characteristics. Probably one of the strongest motives for trying to find effective ways of identifying, measuring, and improving environments is that, at the present time, our methods of controlling the heredity factor for improving intellectual performance are socially unacceptable and scientifically still in their infancy. We may therefore have to work on developing intellect more fully through appropriate, and to some extent controllable, environments.

CHAPTER II

REVIEW OF THE LITERATURE AND THEORETICAL FORMULATIONS

INTELLIGENCE

Historical Orientation

Specifically, the purpose of this study is to examine the relationships between various elements of the home environment and mental ability factors. However, it also falls in the realm of investigations involving the study of general influences of environment and heredity on the development of intelligence. Historically, the problem of whether intelligence is determined by heredity or by environment, the proportion of influence of each, and the interactive process of these two factors dates back to the ideas of Francis Galton (Hunt, 1961; Anastasi, 1965). In his 1869 publication, Hereditary Genius, he stated that most of the people of great reputation and distinction in Great Britain were of high intelligence. He showed that these people were descendants of a relatively small group of families. From this he concluded that this genius or high intelligence was inherited. It is this study by Galton that initiated the nature-nurture controversy relative to the development of human characteristics. He realized that primary to determining the nature of intelligence is the ability to measure this characteristic, so subsequently, Galton ventured into the study and

measurement of individual differences and abilities which, according to Boring (1929), he thought were completely the result of heredity. Since Galton's tests were mainly composed of sensory and motor tasks he obtained very limited relationships with academic ability or with distinction in public office.

In 1890, J. McK. Cattell (as reported by Goodenough in Carmichael, 1954), the first leading psychologist to use the term "mental test", developed an instrument to measure intelligence. These tests were also basically measures of sensori-motor capacities. Cattell's work encouraged other leading psychologists to develop and experiment with similar tests. Because these tests did not appear to measure intelligence, either in the layman's sense or as understood by psychologists of today, the disappointing results led to a temporary cessation of experiments in the area of mental ability measurement in the United States.

In about 1895 Binet and Henri formulated the problem of measuring intelligence on the following terms: "... to determine the nature and extent of individual differences in psychological processes, and to discover the interrelationships of mental processes within the individual" (Hunt, 1961, p. 12). Subsequently in 1905 Binet and Simon, focusing on complex psychological functions, published the first scale to assess intelligence. In 1908 Goddard brought

the Binet-Simon scale to America and translated it into English. As mental ability testing moved beyond the realm of measuring defectives, as in Binet's original intentions and in Goddard's Vineland Training School studies, the problem of what intelligence is, its antecedents, its nature and organization, became significant.

Definition of Intelligence

According to Ebbinghaus in 1897, intelligence was "the ability to combine the elements of experience, or the integrative ability" (Shaffer, 1965, p. 18). Binet (as described by Shaffer, 1965) considered judgment to be synonymous with intelligence. In his definition he included such factors as memory, reason, ability to compare, comprehension, use of number concepts, power to combine objects into meaningful wholes, and knowledge of common events. Spearman (1904) stated that intelligence is comprised of: (a) the ability to observe one's own mental processes, (b) the ability to discover essential relationships between items of knowledge, and (c) the ability to deduce correlates. This concept of intelligence led to a general definition which met with a measure of agreement by British psychologists. It stated that intelligence is: (a) the ability to see relevant relationships between objects or ideas, and (b) the ability to apply these

relationships to new but similar situations (Lovell, 1958). Freeman (1940) saw intelligence as a three concept entity; organic, social, and psychological or behavioristic. Each in its appropriate setting is probably necessary for a complete understanding of human behavior although psychologists have commonly referred to intelligence in the third sense. The psychological concept suggests that intelligence is a characteristic of behavior and is the ability to learn acts or to perform new acts that are functionally useful (Freeman, 1940). Freeman (1950) summarized the various early definitions into three categories: (a) emphasis upon adjustment of the individual to the total environment, (b) intelligence is the ability to learn, and (c) emphasis upon the ability to carry on abstract thinking. Ferguson (1954) described intelligence as a collection of over-learned skills and ideas. These then enable the individual, through differential transfer, to solve novel problems.

A more global definition, presented by Wechsler states that: "Intelligence is the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with the environment ..." (Wechsler, 1944, p. 3). He later stated that, "... general intelligence is the function of the personality as a whole and is determined by emotion and conative factors ..." (Wechsler, 1950, p. 83). Thorndike (1927) divided intelligent activity into three types -- social, concrete, and abstract.

In concert with some of Wechsler's interpretation of intelligence Stoddard (1965) summarized by saying that, in addition to the usual identification of intelligent behavior with cognitive matters such as information, speech, and problem solving, we should insert two additional factors to the definition. These are, creative behavior, and resistance to emotional or other forces that distort the process of reasoning.

Structure of Intelligence

The early developments on the structure of mental abilities progressed along two different philosophies. The British camp developed on the basis of the multilevel hierarchical approach with heavy emphasis on the general Spearman g factor while the American psychologists preferred to view the structure on one level and focus on multi-group factors with minimal weight to any general factors. Probably the first well formulated notion on the structure of intelligence came from Spearman in 1904 (Spearman, 1904). His Two Factor theory included a predominant g factor plus numerous specific s factors. He maintained that everyone possessed, in varying amounts, this mental energy or g factor. After some criticism of his theory Spearman incorporated some intermediate group factors as well as such elements as perseveration and will (Anastasi, 1958b).

Thorndike (1927), Kelley (1928), and Thurstone (1938) pioneered the American point of view. In 1938 Thurstone presented his Multiple Factor theory which incorporated about a dozen group factors operating at one level (Anastasi, 1958b). This structure was a compromise between Thorndike's proliferation of specific abilities and Spearman's global *g*. Six or seven of the factors, known as Thurstone's Primary Mental Abilities, acquired extensive use in the field of mental measurement.

The hierarchical theory for the structure of intelligence was first presented by Burt in 1949 (Burt, 1949). Vernon, in 1950, advocated this model and after some modifications called it the Hierarchical Group Factor Theory (Vernon, 1961). He used Spearman's *g* at the top and moved down the hierarchy to major group factors, minor group factors, and finally to specific skills. Garrett's (1946) idea of the nature of intelligence presumed that all specific abilities develop from one innate general ability. This suggests a hierarchical structure similar to Vernon's. However Vernon's structure does not imply a common general ability from which the specific abilities develop later. The Cumulative Learning Model presented by Gagné (1968) incorporates the idea that intelligence is the result of the accumulation of learning. This accumulation enables the person to develop intellectually by building increasingly complex and interacting structures of learned capabilities.

The development is hierarchical in nature going from simple S-R connections and chaining to complex rules and relationships. Humphreys (1962; Ferguson, 1965) argued that some of the hierarchical models were insufficiently general and advocated Guttman's Facet Theory. Facets are logical dimensions whose elements are the presence or absence of logically defined parts of the dimension. It is a matrix model used for the differentiation of a universe of possible factors.

Another matrix model of the structure of intelligence was developed by Guilford (1959). Factors are classified along three dimensions according to the kind of operation performed on different types of content resulting in particular kinds of products. Many of the 120 combinations have not yet been operationally defined.

An interesting development in the last few decades was Cattell's two factor theory of fluid and crystallized intelligence (Cattell, 1963a; Ferguson, 1965). The fluid factor depends largely on heredity and is involved in tasks which require adaptation to new situations. The crystallized factor is more involved in cognitive tasks in which skilled habits have been "crystallized" as a result of earlier learning. Cattell's theory, in a way, parallels Hebb's thesis of Intelligence A, which represents the "innate potential, the capacity for development", and Intelligence B which is the all-round performance exhibited by individuals

in their everyday life. Intelligence B is the result of the interaction between the innate Intelligence A and the environment and can be measured with appropriate tests. Lovell (1958) said that performance on these tests is what Vernon calls Intelligence C.

Recently Eysenck (1967) reviewed his own model for the structure of intelligence. He has a three dimensional structure consisting of: (a) mental process, (b) test materials with which intelligence is being assessed, and (c) quality. The last dimension includes aspects of intelligence which he considers quite significant -- speed and power. Eysenck also described a model presented by Furneaux in 1960. This model includes, (a) mental speed, (b) continuance or persistence, and (c) error checking mechanisms as the parameters of mental processes. Eysenck concluded by saying that personality variables should definitely be considered as a part of the intellectual structure.

Development of Intelligence

For ardent hereditarians such as Goddard, J. McK. Cattell, or Galton, who believed in fixed intelligence and predetermined development, the development of intelligence was a meaningless process after the child was conceived. During the latter part of the nineteenth century individual differences in intelligence were explained in terms of one

or the other of two mutually exclusive alternatives -- environment or heredity (Burt, 1958). Binet was one of the few at that time who felt that the two factors could both influence the development of intelligence.

A certain amount of evidence, both conceptual and empirical, which was available in the early 1900s, was held to be valid support for the hereditarian notion of fixed intelligence. Findings that showed IQs of children to be considerably constant from childhood to adulthood were such evidence (Hunt, 1961). Correlations of IQ scores between people of varying degrees of genetic relationships was further support. The Jukes and the Kallikaks illustrated the strong effect of heredity in the major study of feebleminded individuals (see Tyler, 1965). Arguments against the denial of environmental influences in this case stated that, because the home environments of these families were so low it really would not matter what transmission of genes took place, there would still be no development of those characteristics referred to as intelligent behavior. Twin studies, starting as early as Galton's time, seemed to be another major source of support for the hereditarians. However, as Tyler (1965) suggested, most of these twin studies also added support for the environmental influence in the development of mental abilities -- it just depended on which questions were being asked. For these studies the degree of genetic relation-

ship could be varied by using identical twins, non-identical twins, siblings, or unrelated children. Environments were then labelled as similar when children were reared in the same home, and different when the children or twins were reared apart. Studies yielding results of the relationships involving the different groups of individuals under the different circumstances were done by Holzinger (1929), Newman, Freeman and Holzinger (1937), Burt (1958), Husen (1960; as described by Ferguson, 1965), Cattell (1963b), Johnson (1963), and Vandenberg (1962). The basis for support of the hereditarian position was that there were small changes in IQ especially in identical twins being reared together and reared apart in presumably different environments. Some of these results are summarized in Table 1. Ferguson (1965) and Hebb (1949) argued that although the twins were reared apart the environments were not really that different and were usually in the same social stratum. They stated that in order to make a legitimate claim that environment is not influential the homes of the separated twins should be entirely different. Johnson's (1963) study supported the importance of heredity by showing that the longer identical twins were separated the more similar their IQs became. On the other hand some psychologists felt that this study supported the environmentalists.

Two other approaches for examining the influence of

TABLE 1

CORRELATIONAL STUDIES OF THE INTELLIGENCE OF TWINS AND SIBLINGS
REARED TOGETHER AND APART

	<u>Group Tests of Intelligence</u>		<u>Individual Tests of Intelligence</u>	
	Burt (1958)	Newman, Freeman, Holzinger (1937)	Burt (1958)	Newman, Freeman, Holzinger (1937)
<u>Identical Twins</u>				
Reared Together	.94	.92	.92	.91
Reared Apart	.77	.73	.84	.67
<u>Non-Identical Twins</u>				
Reared Together	.54	.62	.53	.64
<u>Siblings</u>				
Reared Together	.52		.49	
Reared Apart	.44		.46	
<u>Unrelated</u>				
Reared Together	.28		.25	

(Bloom, 1964, p. 69)

heredity and environment in the development of intelligence were through the study of foster children and institutionalized children. The most extensive studies with foster children were performed by Burks (1928), Freeman, Holzinger and Mitchell (1928), Leahy (1935; as described by Wellman, 1940a), Skodak (1939; as described by Skeels, 1940) and Skodak and Skeels (1949). Skodak's and Skeels' study, by indicating that the correlation of the foster child's IQ with the true parent's educational level or IQ increased as the child grew older, suggested a fairly permanent hereditary influence. As in the twin studies, the strength of the environmental influence was underestimated because the range in the foster home environments was low. Confounding of the results with factors such as selective placement, preadoptive influence, prenatal and natal conditions, and family relationships, in trying to examine the basic heredity and environment factors, produced a variety of divergent conclusions from the foster child studies (Anastasi, 1958a; Anastasi, 1965).

The Iowa studies with nursery school children done by Skeels, Updegraff, Wellman, and Williams (1938), Wellman, Skeels and Skodak (1940), and Wellman (1940b) were directed at investigating the effect of preschool training on intellectual growth. Conflicting results, as well as the many uncontrollable factors, laid these studies open to criticism by people such as McNemar (1945). Tyler

(1965) summarized McNemar's criticisms by saying that evidence of the results being at odds is an indication that there may be an interaction between people and environments.

Probably the more conclusive results with respect to the environmental influence on the development of intelligence are those obtained from studies of deprived and abundant environments. This is one area where criticisms of lack of range in environment do not apply, consequently environmental influences or the lack are likely to show up. Burks (1928) and Sontag et al (1958) found differences of up to 20 IQ points for identical twins having extremely favorable or unfavorable environments. Dennis and Najarian (1957), Newman, Freeman and Holzinger (1937), Kirk (1958), and Wheeler (1932, 1942) found differences ranging from 4 to 21.3 IQ points during exposure of from two to ten years of abundant or deprived environments. The biggest differences per year, other factors being equal, were for the preschool years. Studies by Kirk (1958) and by Lee (1951) were probably most crucial in establishing evidence of the influence of environments in developing mental ability.

Many of the studies cited above, that investigated Anastasi's "Which one?", also attempted to get estimates of "How much?" (Anastasi, 1958a). Burks (1928) while working

with foster parents and their foster children and with parents and their true children estimated about 17 per cent of environmental influence, 75-80 per cent hereditary and about 5-10 per cent due to random somatic environmental effects. Leahy (1935; as described in Bloom, 1964) proposed 78 per cent, Woodworth (1941; as described in Bloom, 1964) 60 per cent, Newman, Freeman and Holzinger (1937) 65-80 per cent and Burt (1958) 77-88 per cent as being attributable to heredity. In spite of these figures Freeman (1940) and Skodak and Skeels (1949) emphasized the role of the home environment in their interpretations. In 1963 Cattell advocated a particular type of analysis of variance for nature-nurture research (Cattell, 1963b). He proceeded by partitioning the total variance into four components: (a) differences of environments between families, (b) differences of heredity between families, (c) differences of environments for individuals within the family, and (d) differences of heredity between siblings within the same family. Much earlier, Holzinger (1929), using intraclass correlations between monozygotic and dizygotic twins, calculated a heritability index (h^2) which is a ratio of the variance attributable to heredity sources to the variance resulting from both heredity and environment. Anastasi (1965) argued, as did Hebb in a previous citing that these proportional contributions obtained by the different methods are not necessarily valid since; (a) the

restricted range of the environment could conceivably reduce the environmental variance to zero, and (b) the assumption of the environmental and hereditary influences being additive, as in the analysis of variance, is not tenable in the light of more recent research (Anastasi, 1965; Hunt, 1961).

Jensen (1967) claimed that knowing proportions may not be of importance. He suggests that the environment influences the development of intelligence as a threshold variable. This means that a minimal environmental influence is required to develop the innate ability. Beyond this threshold level of favorable environment, further influences produce slight differences in observable intelligence (Jensen, 1968). For most persons the innate ability level may be theoretically reached, therefore the heredity sets the limit. However, in the case of genius it is the environment that is the limiting factor.

Probably the most significant contribution by the research done during the last fifty years was in influencing the acceptance of the idea that both heredity and environment are completely essential and influential in the development of mental abilities. The rejection of the idea that heredity-environment is a dichotomy and the acceptance of the interactive nature of these two variables in intellectual development was paramount (Anastasi, 1965). The additive model, strong during the period 1928 to 1939,

was challenged by Stoddard in 1940. By stating that it is essential to think of these two factors as interacting mutually he undoubtedly set the stage for the current approach to the nature-nurture controversy. Recently Hunt (1961), in support of the interactive model, emphasized the role of experience in the development of intelligence but nevertheless assigned an important role to the genes.

Subsequent to Stoddard's stand, various theories of mental ability development and structure have supported his views. Hebb's (1949) concept of Intelligence A and Intelligence B added to the interaction hypothesis. Hebb's description of Intelligence B as the interaction between innate potential and the environment states in detail:

There are, then, two determinants of intellectual growth: a completely necessary innate potential and completely necessary stimulating environment. It is not the point to ask which is more important; hypothetically, we might suppose that intelligence will rise to the limit set by heredity or environment, whichever is lower. Given a perfect environment the inherited constitution will set the pace; given the heredity of genius, the environment will do so (Hebb, 1949, p. 303).

Somewhat similar to Hebb's model is Cattell's fluid and crystallized intelligence (Cattell, 1963a). Fluid intelligence is thought to have a more hereditary basis whereas crystallized intelligence depends more on environmental factors. Additional support for the interaction hypothesis is Piaget's (as described in Shaffer, 1965)

concept of the development of adult intelligence as a logical continuous interaction between the organism and the environment. His adaptive interaction process involves the two complementary processes of assimilation and accommodation, which correspond to inner organization and outer adaptation respectively.

The acceptance of the interactive hypothesis has caused research to move in the direction of Anastasi's (1958a) "How?". That is, "... how both the genotype and the environment operate to produce such phenotypical characteristics as intelligence" (Hunt, 1961, p. 8). Although investigations such as Jervis' (as described in Hunt, 1961) in 1939 and Dobzhansky's (as described in Hunt, 1961) in 1956 are shedding light on the hereditary aspects resulting from genes, a great amount of research is being done in attempting to identify specific aspects of the environment (Hunt, 1961). As Jensen (1967) puts it:

It remains now to identify those environmental factors presently thought to be most potent influences in the development of intellectual and educational potential.... The trend has been away from crude socioeconomic variables towards more subtle intra-family and interpersonal psychological variables (Jensen, 1967, pp. 10, 11).

ENVIRONMENT

Definition of Environment

In the most general sense the term environment is defined as the surrounding conditions, influences or forces which influence or modify (Wellman, 1940a). Warren (1934) saw environmental factors as those which act upon the organism from without and influence its structure or behavior. Wellman (1940a) cautioned that an environment, in the sense that it is studied and measured by psychologists, may not be the same thing that is perceived by, say, a child. It may be that things or conditions that do not have some kind of a direct effect on the child are not part of his environment. Bloom (1964) defined environment as the conditions, forces, and external stimuli which impinge upon the individual.

These may be physical, social, as well as intellectual forces and conditions. We conceive of a range of environments from the most immediate social interactions to the more remote cultural and institutional forces. We regard the environment as providing a network of forces and factors which surround, engulf and play on the individual. Although some individuals may resist this network, it will only be the extreme and rare individuals who can completely avoid or escape from these forces. The environment is a shaping and reinforcing force which acts on the individual (Bloom, 1964, p. 187).

He saw the environment as consisting of both social interactions as well as material and physical objects.

Although environments include the conditions,

influences or forces of the school, the home, and the community and they may affect the development of human characteristics ranging from personality and intelligence to weight, this study was limited to the identification and measurement of the home environment, according to Bloom's (1964) interpretation, as it relates to the development of intelligence.

Measuring Environments

In spite of the provision made in theories of learning and behavior for the influence of environment in the development of human characteristics, very little emphasis has been expressed with respect to the development of measures of the environment. The lack of appropriate environmental measures results in a lack of clearly formulated relationships between environments and the human characteristics whose development they influence. Therefore, we are in need of more specific and precise environmental measures which are likely to be related very directly to the rate and level of development for specific individual characteristics (Bloom, 1964).

In addition to the nominal identification of environments as "foster home" or "nursery school", the first measures of environments were global evaluations such as socio-economic indices or parental occupation. Wolf (1964b) argued against such measures, stating that,

just as general intelligence measures obscure certain important differences among individuals, so do global environmental measures obscure many important differences among environments.

A summary by Loevinger (1940), of studies performed by Goodenough in 1927 and 1928, Coffey and Wellman in 1936, Bayley and Jones in 1937, Stoke in 1927, Stroud in 1928, and Hildreth in 1934 indicated the use of these types of gross environmental measures. They obtained relationships between the social status indices, parents' education, family income and parental occupation, and intelligence test scores in the order of .08 to .58 depending on which environmental measures were considered. They likewise found differences in mean IQ scores up to 20 points between the extreme occupational or socio-economic groups. However there were no clear formulations presented of the nature of specific environmental influences or forces that may have produced such relationships.

Early scales such as those developed by Williams in 1916 (described in Wellman, 1940b), McCormick (1929; as described in Wellman, 1940b), and Chapin (1931) purported to measure environments of school age children. Leahy (1936; as described in Wellman, 1940a) included the following divisions in his home index scale: Children's facilities, economic status, cultural status, sociality, occupational status, and educational status. He obtained

correlations ranging from .20 to .50 between various divisions and the children's IQs. The above scales still emphasized material possessions of the home or community. Although some of the scales such as Leahy's began to be more specific about the environment, the elements of the environment were still basically static. Stoddard and Wellman (1940) reviewed the research done prior to 1939 with respect to the relationships between IQ and environmental aspects such as socio-economic status, and the education and the IQ of the parents. Some of the studies in this group, particularly those of Van Alstyne (1929; as described in Wellman, 1940a; and Stoddard and Wellman, 1940) and Skodak (1939; as described in Skeels, 1940), began to show a trend towards the use of dynamic process characteristics of the home environment. These were used to study the environments of preschool children and included such elements as, conversation between child and parent, reading to the child, encouragement for expression and independent activity, as well as some conventional global environmental characteristics such as the occupation of the parents. As shown in Table 2, Van Alstyne found correlations up to .60 between some environmental scores and children's mental age. Skodak, working with foster children and using a home inventory similar to Van Alstyne's, obtained coefficients of up to .49 between foster parent practices and the foster child's IQ score (reported by

Jones in Carmichael, 1954).

TABLE 2

THE MENTAL AGE OF CHILDREN AS RELATED TO
ENVIRONMENTAL FACTORS
(From Van Alstyne, 1929)

Child's MA by:	r
Mother's education	.60 \pm .05
Father's education	.51 \pm .05
Opportunity for use of constructive play materials	.50 \pm .06
Number of hours adults spent daily with child	.32 \pm .07
Number of playmates in the home	.16 \pm .08
Number of hours father reads to child	.06 \pm .08
Nutrition index	.03 \pm .08

(Reproduced by Jones in Carmichael, 1954, p. 647).

A set of scales designed to measure home environment at a detailed level was constructed by Champney (1941) at the Fels Research Institute. He developed thirty scales for measuring parental behavior. Although the construction of these scales is considered to be one of the first solid attempts at identifying and measuring psychologically and educationally relevant features of a home environment, Baldwin, Kalhourn, and Breese (1945) had limited success in finding evidence as to their validity. On the other hand Kagan and Moss (1962) did find some definite relationships between some of Champney's variables and children's

personality ratings. Pace and Stern (1958) developed an elaborate College Characteristic Index consisting of thirty scales. Although it was considered to be a promising environmental measure not much was done in relating some of these variables to intelligence or personality factors.

The trend toward designing more detailed home environment measures, and particularly in using the dynamic processes and forces of the environment, was carried forward by Fraser (1959) and Douglas (1964) in Britain. Fraser examined home environments through parent interviews in terms of cultural, material, motivational and emotional variables. These four measures were based on eleven more specific sub-variables or process variables. She found significant substantial correlations between all the environmental variables, and both, achievement and intelligence. The overall score for environment correlated .69 with intelligence and .75 with achievement. Douglas' longitudinal study of 5,000 Scottish and Welsh children measured variables such as parent's interest, parental encouragement and educational ambition of the parents for the child, the standard of housing and amenities, the education of the parents, views of the mother on education, and the size of the family. The results of this study seemed to point out that factors such as the nature of the mother's early influences, the extent of parental aspirations and encouragement, and the level of the overall environment are highly

related to the development of academic ability.

Hoffman and Lippitt (1960) hypothesized eleven Family Life variables in a causal sequence schema. The schema involved establishing a linkage between environmental variables and child characteristics, either directly or through some mediating variables. The eleven variables were: Parent Background, Current Family Setting, Family Composition, Relationships Between Parents, Personal Characteristics of Parents, Child Oriented Parental Attitudes, Overt Parental Behavior Patterns, Child's Orientation towards Parents and Siblings, Overt Child Behavior toward Other Family Members, Personal Characteristics of the Child, Child Away from the Family. As the variables progress from one to eleven the causality distance and the need for a mediating variable decreases. The elaborate study by Sears, Maccoby, and Levin (1957), although it was concerned largely with infants, illustrates very clearly the various interactions and forces involved in the home with respect to child rearing and the development of human characteristics. Along with variables which appear to be of the environmental process category, they also included some of the standard socio-economic status variables. A factor analysis of the Sears et al child rearing interaction measures resulted in seven distinct dimensions. Witkin et al (1962), in that part of their study which investigated the role of early life experiences in their contribution to the development of

differentiation in the child, measured characteristics of the home, school, and community environments. The variables included attitudes of the parents, child-parent interactions in the home, particularly the mother's, as well as child activities outside the home. Ultimately a detailed analysis of the mother-child interaction variables was performed and relationships were established with respect to, interaction which fostered differentiation, and interaction which inhibited differentiation. Lowry (1968) designed a parent questionnaire to measure the home environment in terms of: (a) the use of language in the home, (b) early experiences of the child, and (c) the availability and use of books and other reading materials. The schedule included items which investigated both, the conventional static, as well as the dynamic interaction aspects of the environment. Using the results of the questionnaire to establish relationships with reading achievement of second grade pupils he found significant results for subtest (b) and (c) but not for (a).

In summarizing the studies of Van Alstyne, Skodak, Champney, Fraser, Douglas, Sears et al, Hoffman and Lippitt, and Witkin et al we find that their scales measured, to a large extent, dynamic process characteristics of the environment. These studies serve as a link between the traditional methods of measuring environments in terms of socio-economic status characteristics and the more recent

process characteristic approach. The scales developed by these people can indeed be considered the forerunners of the present environmental process variable scales.

Environmental Process Variables

We have now moved beyond the global measures of environments into what Dave (1963) and Wolf (1964a) have called environmental process variables.

The environment for the development of intelligence is a subset of external events, conditions, and processes from the total environment and constitutes a psychological press for the development of intelligence. A press for the development of intelligence may be present in a variety of situations -- the home, the school, the church, and the community (Wolf, 1964a, p. 27).

Dave (1963), Wolf (1964a), and Dyer (1967) have focused on those psychological presses operating in the home and constituting the environment for the development of intelligence, and have called these presses, environmental process variables. In attempting to identify these variables Dave and Wolf were careful not to construct just another scale of conventional status variables. Bloom (1964) stated that it is not only the availability of certain elements in the environment that is important, but also the extent to which the individuals interact with or in them. Keeping this in mind Wolf proposed the following list of variables representing ongoing processes in the environment (Wolf, 1964a, p. 30):

(1) Stimulation provided in the environment for verbal development.

(2) Extent to which affection and reward are related to verbal reasoning accomplishments.

(3) Encouragement of active interaction with problems, exploration of the environment, and the learning of new skills.

These variables presumably describe ongoing processes which can have direct consequences for the development and maintenance of intelligence (Wolf, 1964a). As mentioned previously many of the variables in Van Alstyne's, Champney's, Fraser's, Douglas', Hoffman's, Witkin's, and Lowry's scales were of a similar nature.

Wolf identified those environmental process variables (E.P.V.) which he hypothesized would relate to general intelligence. His three E.P.V. s consisted of: (1) Press for Achievement Motivation, (2) Press for Language Development, and (3) Provision for General Learning. These three E.P.V. s were then broken down into thirteen descriptive sub-variables called environmental process characteristics. The variables and characteristics were then evaluated on the basis of the mother's responses to questions in an interview schedule consisting of specific items about behaviors which were related to intellectual development. Dave (1963), also working in Chicago, used the following six E.P.V.s to measure environments: (1) Achievement Press, (2) Language Models, (3) Academic Guidance, (4) Activeness of the Family, (5) Intellectuality in the Home, (6) Work

Habits in the Family. As in Wolf's study these six variables were divided into nineteen process characteristics and evaluated through the use of an interview schedule.

Dyer (1967) in partially replicating Dave's study, used the first five E.P.V.s. However, he replaced the sixth variable with a Family Security variable proposed by Vernon (1965a).

Upon analysis of his data Wolf found a correlation of .69 between the total environmental measure and general ability of fifth graders as measured by the Henmon-Nelson Test of Mental Ability. ["Total environmental measure" represented the sum of the three environmental process variable scores]. The multiple correlation, between intelligence and the three E.P.V.s was .70, and between intelligence and the thirteen environmental process characteristics was .76. Dave related the environmental variables to school achievement. He found that the total environmental scores, which he called the Index of Educational Environment, correlated .80 with the school achievement. Dyer, using two classes of Standard IV Trinidadian students (10-11 years old), found correlations between the Index of Educational Environment and:

(a) achievement were .67 and .78, (b) non-verbal intelligence were .32 and .51, (c) verbal intelligence were .11 and .39.

The achievement measure was the Iowa Test of Basic Skills and the intelligence test was the Lorge-Thorndike Level 3.

Vernon (1965a; 1965b, Pt. I, II), in his cross cultural study of English, Jamaican, and Eskimo eleven year old boys, investigated the correlates of intelligence test performance. Specifically, he used various environmental elements to establish relationships with intellectual ability factors. Although Vernon did not call his variables environmental process variables, five out of his nine variables were of the dynamic interaction press type. Referring to the English sample only, we notice that the highest loading is .56 on the g factor of intelligence by the Cultural Stimulus environmental variable (Vernon, 1965b, Pt. II). Vernon's other environmental variables which could be considered E.P.V.s were Encouragement of Initiative, Male Dominance, Family Planfulness, and Linguistic Background (Vernon, 1965b, Pt. I).

DIFFERENTIAL ENVIRONMENTS - DIFFERENTIAL ABILITIES

Bloom (1964) said that certain studies indicate that different environmental profiles, or aspects of the home environment, are related to the development of different types of mental abilities. Wolf (1964b) in his study conceived of specific environments for the development of particular characteristics, however, he did not

examine the differential aspects of mental ability.

An environment that is quite favorable for the development, let us say, of independence and self-reliance may differ in significant details from an environment that is favorable for the development of social conformity, or abstract thinking (Anastasi, 1966, p. 305).

The nature of the interaction in the home could be conducive to the development of special mental abilities. Good language environments in the home will stimulate the development of verbal ability as well as test-measured general intelligence. An environment which provides opportunities and encourages the individual to attempt new and challenging tasks may facilitate the development of certain types of mental abilities. Vernon (1965a) said that we should investigate environmental influences or other causal agencies that underly the development of different patterns of abilities. He stated that we should examine certain environmental factors and look for associations between them and the peaks or troughs in the ability factor patterns or profiles derived from a variety of tests (Vernon, 1965b, Pt. I). In addition, he claimed that it is "... meaningful to study the effects of controllable environmental factors on the development of various types of abilities ..." (Vernon, 1965b, Pt. I, p. 9). Bloom added that there is a need to measure different environment variables which are not too highly related and to describe and relate these different aspects to human characteristics, especially those

which have already been well identified.

Although environmental measures such as those used by Wolf, Dave, and Dyer consisted of multiple variables characterizing the dynamic home presses they did not seem to represent disparate or differential environmental aspects. For example, when Wolf factor analyzed the inter-correlation matrix of the E.P.V.s the first factor of the unrotated factor matrix accounted for 79.6 per cent of the communality (Wolf, 1965a). Dyer factor analyzed his seventeen environmental process characteristics and obtained only one substantial factor accounting for 75 per cent of the total variance (Dyer, 1967). A similar procedure with Dave's (1963) data produced a single factor accounting for 60 per cent of the total variance. It appears then, that although three E.P.V.s were hypothesized in Wolf's scale, and six in Dave's and Dyer's, there were high correlations among the E.P.V.s, hence indicating that a single environmental factor permeates each of the scales when applied to their particular samples. MacArthur (1967), using Vernon's (1965a) Eskimo sample, factor analyzed Vernon's nine environmental influences and obtained four oblique, relatively uncorrelated primary factors. The factors were, White Acculturation, Initiative and Independence, Health, and Socio-Economic Status. Although this analysis suggests a differential measuring instrument we must realize that factors such as White Acculturation or Health may not

discriminate among environments in a white urban society.

Environmental Correlates of Differential Abilities

It was stated earlier that the objective of this study was to examine the environmental process variables in the home differentially and relate them to different ability factors or patterns. As indicated in the preceding paragraph attempts at designing differential measures of home environments have not been very successful. However, a considerable amount of work has been done in the last few decades which shows relationships between particular types of environments measured individually, and the development of certain types of intellectual abilities. Various studies, and especially Vernon's (1965a) provide encouragement and empirical support for further research in such directions. Some of Vernon's results should, however, be interpreted with caution for our culture since the research in many cases was done with subjects from cultures quite different from those of North America or Europe.

The results of Vernon's (1965a) recent cross-cultural study indicated that homes where parents failed to answer questions, encourage curiosity, and provide books, prevented the full development of verbal conceptual abilities. On the other hand, female dominance in child rearing as well as dependency fostering and overprotective home environments

tended to favor verbal development at the expense of spatial and non-verbal abilities. Support for this finding comes from Ferguson (1966), Levy (1943), Witkin et al. (1962), Bing (1963), Dyk (1967), Honzik (1967), and Moss and Kagan (1958). In addition to the above studies, research by Denton (1967) and Dawson (1967) provides more empirical evidence for the dependency fostering, overprotective influence. Witkin (1962) says that children in over-protective, dependency fostering homes do not acquire the self-discipline required to do arithmetic and other similar non-verbal tasks. An environment in which there is encouragement and provision for initiation and completion of tasks facilitates the development of spatial, numerical and abstract reasoning abilities. This relationship was shown in studies by Vernon (1965a), Bing (1963), Ferguson (1966), and by Freedman (1965). Dyk (1967), Jensen (1967), Vernon (1965c), and Ferguson (1966) again, have likewise demonstrated that environments which allow for a high degree of interaction with the physical aspects, and thus provide considerable visual and kinaesthetic experiences, facilitate the development of spatial and perceptual abilities.

Witkin (1962) in his parent-child relationship studies discovered that an authoritarian environment where conformity and severe standards were demanded, served to interfere with differentiation but might have contributed to the development of verbal skills. Haggard (1957) found that

children who were trained to conform and adhere strictly to parental regulations performed higher on verbal skills than on non-verbal. The studies by Dawson (1967), Dyk (1967), and Vernon (1965c) supported the above finding of the influence of an authoritarian home environment.

Vernon (1965a) and Schaefer and Bayley (1963) contended that family security and planfulness in the home facilitate the development of internal controls and rational thinking which would relate to high performance on various numerical and non-verbal tasks. Honzik (1967) had some conflicting evidence with respect to the family security variable. She found that a certain amount of parent disagreement with respect to discipline, is associated with performance rather than with verbal skills, especially with boys. However, Vernon's correlation of Family Security with g would suggest that this environmental variable would influence the development of general intelligence.

Bing (1963), using a questionnaire and an interview, found that an environment which has ample opportunity for early verbal stimulation, and has considerable verbal freedom is associated with children who score high on the verbal sections of intelligence tests. The high scorers on "language IQ" measures in Milner's (1951) group came from a much richer verbal family environment. This included availability of books, adults reading to children, and opportunity for verbal interaction between the children and the parents.

Hess and Shipman (1965) have shown that the mother's interaction with the child in the home with respect to the utilization of verbal concepts was related to the style of the child's problem solving rather than to the level of intellectual development. Freeberg (1967) pointed out that higher overall IQ scores were related to situations which attempted to teach higher order verbal abstractions and provide broad verbal stimulation in play situations. Wolf (1964a) obtained a correlation of .64 between language press in the home and overall intelligence.

A very significant element of the home environment was investigated by Bernstein (1961). He contended that children from homes where a "formal" language, as opposed to an implicit meaning "public" language, perform at a higher level both in verbal as well as in overall intelligence.

Bing (1963) discovered that children with high verbal performance on intelligence tests came from homes where emphasis was placed on academic achievement in terms of setting levels, and rewarding high and criticizing low achievement. Wolf's (1964a) achievement motivation environmental variable correlated .568 with overall intelligence. Parental interests, knowledge, and encouragement with respect to the child's studies, as well as aspirations and expectations were found by Douglas (1964) to be a much more significant element of the environment for academic performance

than other variables such as standard of the home, family size and other socio-economic types of characteristics. He found that this aspect of the environment facilitated the development of verbal abilities somewhat more than it did the performance ones. Freeberg (1967) summarized a number of studies on the environmental influences toward the development of intelligence. He found that high parental aspirations for themselves and their children, as well as positive attitudes towards achievement, were related highly to the children's achievement and intellectual performance. Rosen's (1956) study likewise pointed out the influence of parental aspirations and expectations on verbal and general intellectual development.

Although the various characteristics of the environments described above have been found to influence the development of different types of abilities it may be worthwhile to think for a moment in terms of only verbal and non-verbal abilities. Bing (1963) presented a variety of characteristics for these two categories of intelligence. Verbal ability should be associated with: (a) Verbal stimulation and interest shown by the mother, (b) Verbal freedom, (c) Emphasis on academic achievement, (d) Emphasis on sociability, and (e) Mother's dependency fostering behavior. Non-verbal ability should be associated with: (a) Non-verbal stimulation and freedom of exploration, (b) Freedom to explore the environment, and permissiveness

for early exploration, (c) Opportunity for object experimentation, (d) Emphasis on sex-typing and parents' own non-verbal interests, and (e) Mother's independency fostering behavior.

Indirectly, facilitation of any ability factor development would be facilitation of the overall ability provided that one particular ability does not develop at the expense of the other. It would be safe to state, on the basis of research, that, because of what our society and schools consider to be intelligent behavior, any verbal development is going to affect, quite directly, the performance on most tasks and especially those in intelligence tests. Bloom (1964) supported this conclusion as did Milner (1951) and Douglas (1964). It would seem that relationships established by Wolf (1964a) and Dave (1963) may fall into the above category. Their E.P.V.s although they appear upon examination to be such that would facilitate verbal and academic performance, do relate highly to overall ability.

On the basis of the research cited up to this point on the relationships between environmental characteristics and different mental abilities, ten aspects of the environment were selected for this study as being important for cognitive development. These ten environmental characteristics will be mentioned in Hypothesis 2 of this chapter and will be described in detail in Chapter III.

In conclusion it is worthwhile noting that a number of environments, described in terms of dynamic interactive process characteristics, are related to overall or general intelligence. Honzik (1967) pointed out that children obtaining the highest IQs in a particular study came from homes of demanding parents. Moss and Kagan (1958) found that early maternal concern with achievement, particularly for boys, facilitates early intelligence test performance. A purposeful, planful, secure home has been shown by Vernon (1965c), and by Schaefer and Bayley (1963) to be related to overall intellectual level.

HYPOTHESES

In the light of the above research and theoretical formulations two purposes were assigned to this investigation. The first one was to identify and measure the dynamic characteristics of the home environment in terms of different environmental process variables and the second was to examine the relationships of these variables with different types of ability patterns.

In keeping with these objectives the following hypotheses were presented for testing:

Hypothesis 1. The Differential Environmental Process

Variable Scale (DEPVAR) will provide a differential measure of home environments.

Hypothesis 2. (a) DEPVAR variable or DEPVAR factor scores representing environmental characteristics of (i) academic and vocational aspirations and expectations, (ii) knowledge of, and interest in, the child's academic and intellectual development, (iii) material and organizational opportunities for the use and development of language, and (iv) quality of language in the home, will relate highly to scores representing academic and verbal types of mental abilities.

(b) DEPVAR variable or DEPVAR factor scores representing environmental characteristics of female dominance in the home, will relate higher to scores representing verbal abilities than to scores denoting spatial, numerical, and reasoning types of abilities.

(c) DEPVAR variable or DEPVAR factor scores representing environmental characteristics of planfulness, purposefulness, and harmony in the family in the home, will relate highly to scores representing numerical and reasoning types of mental abilities.

(d) DEPVAR variable or DEPVAR factor scores representing environmental characteristics of dependency fostering and overprotection in the

home, will relate higher to scores representing verbal abilities than to scores denoting spatial, numerical and reasoning types of abilities.

(e) DEPVAR variable or DEPVAR factor scores representing environmental characteristics of authoritarianism in the home, will relate lower to scores representing spatial, perceptual, numerical, and reasoning types of abilities than to scores denoting verbal abilities.

(f) DEPVAR variable or DEPVAR factor scores representing environmental characteristics of interaction with the physical environment (visual and kinaesthetic experiences) in the home, will relate highly to scores representing spatial, perceptual, and reasoning types of abilities.

(g) DEPVAR variable or DEPVAR factor scores representing environmental characteristics of opportunity for, and emphasis on, initiating and carrying through tasks in the home, will relate highly to scores on numerical and reasoning types of abilities as well as to overall intelligence.

Hypothesis 3. The DEPVAR variable scores for the ten DEPVAR variables will be different for the High and the Low socio-economic status samples.

Hypothesis 4. The relationships between the DEPVAR variable and the DEPVAR factor scores, and overall intelligence, will be different for the High and the Low socio-economic status samples.

CHAPTER III

INSTRUMENTS USED

THE DIFFERENTIAL ENVIRONMENTAL PROCESS VARIABLES

INTERVIEW SCALE

As mentioned earlier it was the intention of the investigator to measure the home environment differentially. Wolf (1964a) and Dave (1963) developed an instrument which could conceivably measure environments in this manner. Dyer (1967) subsequently produced a modified form of Wolf's and Dave's scale. However, a factor analysis of the results from their instruments reduced the scales to one-factor measures of the home environment. It was hoped that the instrument designed for this study would measure a number of rather independent environmental factors in terms of patterns, and that these factors or patterns would relate to different mental ability factors or patterns. This instrument is referred to as the Differential Environmental Process Variables Scale (DEPVAR) and would identify and measure ten characteristics of the home environment.

Various methods of obtaining information for the scale were considered, among them, the questionnaire, direct observation, and the interview. The decision to use the interview as the data gathering technique was based on the expectation that: (a) the face to face nature of the

interview allowed the possibility of eliciting a high degree of cooperation on the part of the interviewee, (b) there was an opportunity to ask the interviewee additional questions when necessary, (c) the oral responses provided for a greater amount of detailed information, and (d) the information regarding the dynamic process of the environment was more readily obtained by this technique (Wolf, 1964a). It has been suggested that the interview technique will introduce subjectivity and bias of the interviewer and that one could eliminate this by using a highly structured question schedule. Although a highly structured or standardized question interview would have probably increased objectivity and reliability it may have in turn diminished the validity of the obtained information through a lack of flexibility. In concurrence with Wolf (1964a) it was decided that the focused interview, as described by Good and Scates (1954), would provide the needed flexibility to elicit valid information in terms of environmental process variables.

The DEPVAR Scale in focused interview form, was used with the mother, who it was assumed would possess the necessary information about the home environment, especially as it related to the intellectual development of the child. Support for using the mother, came from Hoffman and Lippitt's (1960) summary of research with respect to this point. They stated that mothers are more available and better informed

than fathers. Some of the studies (Honzik, 1967) also pointed out that a parent feels more responsible for rearing his own sex child. The questions about upbringing are therefore going to be more threatening and the parent will be more likely to be defensive and give distorted, socially acceptable responses. Since this study used boys only, it was decided that mothers would be a more valid source of information about home conditions than fathers or any other members of the home (Honzik, 1967).

The development of the DEPVAR focused interview schedule was assisted by consulting existing schedules such as Wolf's (1964), Vernon's (1965b, Pt. I), Lowry's (1968), Milner's (1951), and Sears' et al.(1957). In addition to surveying these schedules, reference was made to Moser (1958), Merton et al.(1956), Goode and Hatt (1952), and Travers (1958) to obtain a sound theoretical basis for the construction of interview questionnaires. The schedule consists of specific questions about particular types of behavior and conditions in the home which would be representative of ten different environmental process variables. These questions were selected on the basis of some existing instruments such as Wolf's (1964a), Bing's (1963), Honzik's (1967), and Douglas' (1964), and on the basis of theoretical and empirical work done in the areas of child development and educational psychology. A preliminary draft of the schedule was examined by three experts in the field. The revised

draft was then administered to six mothers who had boys in Grade 4. Following the analysis of these interviews certain questions were added while irrelevant or duplicate questions were deleted. The final schedule consisted of fifty-nine questions with about three to four sub-items in each question which described nine of the ten different aspects of the home environment in terms of environmental process variables. The tenth variable was measured by examining the length of the communication units (defined in a subsequent paragraph) in the responses. It was anticipated that the new scale, consisting of questions tailored to all socio-economic levels, would provide measures which have greater range in level and type of interaction and behaviors in the home than previous or existing measures of dynamic environmental characteristics.

The ten environmental process variables which were investigated are:

- (1) Academic and Vocational Aspirations and Expectations of Parents.
- (2) Knowledge of, and Interest In, Child's Academic and Intellectual Development.
- (3) Material and Organizational Opportunities for the Use and Development of Language.
- (4) Quality of Language in the Home.
- (5) Female Dominance in Child Rearing.
- (6) Planfulness, Purposefulness, and Harmony in the Home.
- (7) Dependency Fostering - Overprotection.

- (8) Authoritarian Home.
- (9) Interaction with Physical Environment (Visual and Kinaesthetic Experiences).
- (10) Opportunity for, and Emphasis on, Initiating and Carrying Through Tasks.

Variable one is a measure of the level of parental expectations and aspirations for the child in the areas of, present and future academic studies, and a future career. The extent to which some action is being taken or plans being made to substantiate these aspirations and expectations was examined by Variable one. The variable name as well as some of the schedule questions are similar to those in Wolf's (1964a) scale. However, whereas Wolf related his variable to overall intelligence, the variable in this study was primarily examined for its relationship with verbal ability.

Variable two is also a modification of Wolf's scale except here again an attempt was made to examine the relationship between this variable and verbal intelligence. The presence of this variable or characteristic was indicated by the extent to which the parents are interested and informed with respect to their child's academic progress and intellectual development. Knowledge of how the child is doing in school, frequent contact with school personnel, as well as their own appraisal of the child's development, were the conditions and behavior necessary to rate highly on this variable.

Variables three and four correspond to Wolf's environmental process characteristics representing the language press variable. The schedule questions were modified, and again, as for the first two variables, the relationship of these two environmental characteristics to the development of verbal ability was noted. Variable three measured the extent of deliberate and constant efforts made to provide opportunities for the use and development of language and vocabulary. The home environment in terms of, the situations designed by the parents to encourage verbalization, the availability and use of verbal facilities, as well as the conscious awareness in the home of the value of verbal facility in the future, was examined by this portion of the schedule.

The quality of the language model in the home, which is the fourth variable, consisted of a rating of the mother's language usage during the interview. This variable measured the quality of the mother's language as might be characterized by Bernstein's (1961) formal or public language. The limitations of this study prohibited a detailed study of language in terms of characteristics such as maturity and complexity as defined by the extent to which subordinate clauses, conjunctions, adverbs, adjectives, and prepositions were used, as well as the number of "kernels" imbedded in a sentence (Loban, 1963; Hunt, 1965). Consequently a decision was made to evaluate the language model by measuring the

length of the communication units (T-units) which Loban (1963) described as the smallest group of words which cannot be further divided without the loss of their essential meaning. O'Donnell (1968) stated that the mean T-unit length is a useful index for measuring structural language complexity. Loban (1963) and Hunt (1965) both claimed the T-unit to be an indicator of language maturity. In effect the T-unit measures, by implication, the complexity, maturity, and formality of the language. In the present study language model ratings were obtained by examining the T-unit lengths of the mothers' responses.

The decision to develop and use Variables five, six, and nine came as a consequence of evidence from Vernon's (1965a; 1965b, Pts. I, II) study. The basic environmental characteristics as indicated by Vernon were translated into behavioral elements to develop this portion of the instrument for the present study.

The fifth variable evaluated the environment in terms of the extent to which the mother assumes the child rearing duties in the home, and the extent to which the father abstains from such duties. The lowest value for this variable represented a condition where both parents shared the child rearing responsibilities, where the father was home daily from his job, and where the father devoted a considerable portion of his time to activities with the child.

The amount of joint family activity and the degree of planning with respect to holidays, purchases, and future activities was measured by Variable six. The extent of similarity in child rearing practices by the parents, and the agreement by both on how the practices differ, was determined.

Variable seven was used to examine the home environment with respect to dependency fostering, and the amount of overprotection of the child. Evidence of consistent cautiousness training, and structuring of situations for the child to avoid any potential dangers or embarrassment for him, was construed as an overprotective environment. Characteristics of the home such as "doing things" for the child because he is considered "not old enough" likewise contributed to a high score on this variable. The other end of the scale for this variable was represented by homes where the child was permitted to try new activities or go to "foreign" places at an early age, where the anxiety of the parents was low with respect to overexposure to degrading and dangerous elements, and where imperfect performance by the child was tolerated.

Rigid parental behavior demanding unreserved and undifferentiated obedience was characteristic of an environment loading highly on Variable eight. The authoritarian environment included inflexible rules, intolerance of aggression towards parents, severe, often physical punish-

ment for "inappropriate" behavior, and parental operation on a good-bad dichotomy with respect to behavior. The parent's role was one of power while the child's responses were based on fear.

Variable nine evaluated the environment on the basis of the opportunity available for, and the extent of, the interaction by the child with the physical environment. Conditions such as, variety or sophistication of toys, involvement in kinaesthetic hobbies, early use of appliances, and parental non-verbal interests, were characteristic of a home environment which provided visual and kinaesthetic experiences.

An environment where there was provision for a child to initiate and carry through with tasks was characteristic of the tenth variable. The environment should be such that attempting, and especially completing tasks should be rewarded. Evidence of the child attending to home chores without being reminded continually suggested that such environmental characteristics were present in the home.

The fifty-nine items in the schedule, shown in Appendix A, were categorized to evaluate the nine variables (excluding Variable four). Table 3 shows the breakdown of the items. It should be noted that, although most of the items were assigned to only one variable, there were some sub-items which contributed to more than one variable.

TABLE 3

ASSIGNMENT OF DEPVAR ITEMS FOR THE DIFFERENTIAL
ENVIRONMENTAL PROCESS VARIABLES

Variables	Item Numbers
1. Academic and Vocational Aspirations and Expectations of Parents	1, 2, 3, 4, 5
2. Knowledge of, and Interest In, Child's Academic and Intellectual Development	6, 7, 8, 9, 10, 11
3. Material and Organizational Opportunities for the Use and Development of Language	12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 (-44c, -54a, -54b; 1 item)
4. Quality of Language in the Home	(Calculated from mean T-unit length).
5. Female Dominance in Child Rearing	24, 25, 26, 27, 28, 29 (7b, -8a, -8c, -50b, 50c; 1 item)
6. Planfulness, Purposefulness, and Harmony in the Home	30, 31, 32, 33, 34, 35 (19a, 20a, 37b; 1 item)
7. Dependency Fostering - Overprotection	36, 37, 38, 39, 40, 41 42, 43 (-21a, 45a, -53a, -53b, -53c; 1 item)
8. Authoritarian Home	44, 45, 46, 47, 48 (-19b, -19c, -21a, 36b, 36d, 40a, 40b, 41a, 41b, 42a, 42b, 55d, 59a; 3 items).
9. Interaction with Physical Environment (Visual and Kinaesthetic Experiences)	49, 50, 51, 52, 53, 54 (31a, 31b, -38b, -39a, -39b, -39c, -39d, 55a, -59b; 2 items)
10. Opportunity for, and Emphasis on, Initiating and Carrying Through Tasks	55, 56, 57, 58, 59

Note: Sub-items which contributed to variables other than those to which they were basically assigned are given in the parentheses. The item equivalence of these sub-items is also given in the parentheses.

To obtain estimates of the ten process variables a rating scale was designed for each variable. Although the number of classes in a scale could have ranged from two to as many as twenty-five, it was decided, on the basis of Symond's (1931; as described in Wolf, 1964a) recommendations, as well as Wolf's (1964a) successful study, to use seven classes. Except for Variable four the items were rated on the basis of a seven point scale. Classes 7, 5, 3, and 1 were given verbal descriptions which described the types of behaviors or conditions that warranted particular ratings. The first reading of the transcribed protocols for the one hundred interviews provided the writer with the range of responses for each sub-item. On the basis of these responses and the verbal rating scale (Appendix B), a 7-point scoring key, shown in Appendix C, was designed to rate the specific sub-item responses describing the behaviors and conditions in the home. Without the knowledge of the boy's abilities, each protocol was then scored by evaluating the sub-item ratings which were subsequently averaged with equal weights to obtain item scores. The scores for the groups of items as categorized in Table 3 were subsequently averaged with equal weights to yield the respective variable scores. The rating for Variable four was obtained by sampling the responses for six items (5, 20, 26, 27, 37, 40) from the schedule and calculating the mean number of words per communication unit (T-unit). The scores for this variable

were then transformed, separately for Group 1 and Group 2, to values with a mean of 4.0 and a standard deviation of 1.3.

To illustrate the method of scoring, Item 21 from the DEPVAR Interview Schedule in Appendix A is used as an example. A typical response to sub-item 21(a) by a parent could be, "His most frequent questions are about how things work and why people do certain things". This same mother could respond to sub-item 21(b) with, "He asks both types of questions". Referring to the Scoring Key in Appendix C we would score the 21(a) response as 7 and the 21(b) response as 5. Adding the two scores with equal weight and rounding the average of the two sub-items to the nearest whole number (half values rounded to lower whole) we obtain a score of 6 for Item 21.

The ten DEPVAR scores, as well as the factor scores based on the factor analysis of the ten variables, were examined with regard to their own validity and with regard to their relationships with the ability scores and patterns.

The veracity of the responses depended on the appropriateness of the questions in the Interview Schedule, and on the degree of rapport established by the interviewer. The limitations of the study prohibited the administration to the child of a questionnaire of the type proposed by Roe and Siegelman (1963), in order to get the child's perception of the parents' behavior.

Validity of A Priori Item Assignment

Using the 100 subjects a Principal Axes factor analysis of the items, extracting nine factors, was performed to validate the a priori assignment of items to the nine variables. The Equamax orthogonal rotation matrix of loadings (Table 4) was used and a value of 0.350 was arbitrarily considered to be the lower limit for an adequate or meaningful loading. The total variance accounted for by the 59 items on the nine factors was 26.66, or 45.2 per cent of the total variance.

The factor loadings showed the greatest support for the a priori assignment of items for DEPVAR Variables five, eight, nine, and ten (Female Dominance; Authoritarianism; Environmental Interaction; Completing Tasks). These were represented by Factors 1, 5, 2, and 7 respectively. For each of these factors the designated items had adequate loadings. There were however, a few non-assigned items loading more than 0.350 on some of these four factors. Support for the DEPVAR Variable one (Aspirations, Expectations) clustering of items was not complete. Only a few of the assigned items loaded on Factor 3, which was presumed to be Variable one. Although the DEPVAR Variable three (Opportunity for Language Development) items did not all load adequately on a single factor we did find that the greatest number of Variable three items loaded highly on Factor 9. Some of

TABLE 4
DIPVAR ITEM ORTHOGONAL EQUIMAX ROTATION FACTOR LOADING MATRIX FOR GROUP 12
(N=100)

DIPVAR Items	1	2	3	4	5	6	7	8	9	h^2
1	-0.223	-0.124	0.042	0.097	-0.163	0.566	0.025	-0.039	0.074	0.431
2	-0.139	-0.179	0.377	0.313	-0.222	0.209	-0.171	0.066	-0.001	0.438
3	0.091	0.278	0.461	0.168	0.031	0.325	-0.236	-0.155	0.035	0.514
4	0.007	0.356	0.257	0.232	0.009	0.046	0.090	0.005	0.352	0.412
5	-0.171	-0.081	-0.003	0.327	-0.034	0.337	0.086	0.100	-0.064	0.279
6	0.072	0.155	0.059	0.673	-0.194	-0.008	0.230	-0.090	-0.036	0.586
7	-0.344	0.390	0.003	0.035	-0.137	0.298	0.323	-0.243	0.002	0.543
8	-0.487	0.347	0.051	0.036	-0.195	0.351	0.182	-0.083	0.161	0.591
9	-0.121	0.148	0.084	0.522	-0.156	-0.112	0.080	-0.067	-0.211	0.407
10	-0.135	0.263	-0.004	0.243	0.065	0.126	-0.220	-0.264	-0.337	0.409
11	-0.261	0.258	0.033	0.238	-0.026	-0.048	-0.019	-0.195	0.212	0.295
12	-0.025	0.085	0.616	0.338	-0.138	0.116	0.079	-0.131	0.242	0.616
13	0.023	0.235	0.253	0.244	-0.086	0.293	-0.152	-0.119	0.494	0.554
14	0.121	0.312	0.114	0.218	-0.139	0.216	0.082	0.120	0.142	0.294
15	0.029	0.163	0.294	0.303	-0.022	0.382	-0.005	-0.213	0.175	0.490
16	0.129	0.205	0.103	0.032	-0.118	0.144	-0.006	0.299	0.308	0.288
17	-0.067	0.059	0.638	-0.110	0.140	0.107	0.013	-0.126	0.521	0.346
18	-0.223	0.180	0.225	-0.039	-0.102	0.185	0.295	-0.257	0.447	0.552
19	-0.222	0.053	0.238	0.339	0.056	0.090	-0.014	0.073	0.224	0.507
20	-0.091	0.389	0.318	0.237	-0.039	0.229	0.223	-0.215	0.144	0.485
21	-0.161	0.134	0.641	0.052	-0.082	0.731	0.187	0.111	0.080	0.572
22	-0.146	-0.178	0.190	0.108	-0.032	-0.065	0.173	0.197	0.422	0.349
23	0.060	0.128	0.555	-0.170	-0.145	-0.048	0.278	-0.082	-0.178	0.497
24	0.494	0.162	-0.013	-0.141	0.002	-0.300	-0.015	0.085	-0.009	0.588
25	0.740	-0.039	-0.123	-0.057	0.081	-0.108	-0.164	-0.030	-0.053	0.618
26	0.719	0.104	-0.114	-0.158	0.050	0.096	0.016	0.119	-0.234	0.637
27	0.561	0.074	0.072	-0.056	0.036	0.153	-0.174	0.090	-0.059	0.400
28	0.579	-0.041	0.035	0.154	-0.070	-0.075	0.164	-0.313	-0.107	0.504
29	0.592	-0.175	-0.330	0.191	-0.206	-0.045	0.078	0.044	0.131	0.585
30	0.012	0.072	0.033	-0.169	-0.343	0.224	-0.017	0.210	-0.204	0.288
31	-0.333	0.359	0.184	0.332	-0.053	0.216	0.085	-0.024	-0.032	0.442
32	0.022	0.152	0.170	0.640	-0.078	-0.051	0.173	-0.186	0.100	0.545
33	-0.102	-0.041	0.075	-0.290	-0.049	0.545	0.076	0.068	0.010	0.412
34	-0.277	0.114	-0.202	-0.197	-0.274	-0.072	0.146	0.001	0.218	0.291
35	-0.109	-0.271	0.204	-0.234	-0.228	0.059	0.248	-0.357	0.062	0.429
36	-0.040	0.083	0.033	-0.135	0.084	-0.020	0.120	0.639	-0.164	0.485
37	0.091	0.030	-0.001	0.001	0.113	0.515	-0.006	0.143	-0.005	0.308
38	0.133	-0.022	0.082	-0.120	0.024	-0.097	-0.079	0.662	-0.012	0.485
39	-0.113	-0.238	-0.054	0.002	-0.138	0.076	0.029	0.539	-0.025	0.389
40	0.020	-0.004	-0.278	0.046	0.107	0.063	0.027	0.539	0.115	0.400
41	0.109	0.018	-0.537	-0.213	0.006	0.393	0.067	0.131	-0.135	0.540
42	0.162	0.096	0.152	0.045	0.053	0.178	0.031	-0.003	-0.606	0.464
43	0.000	0.038	-0.177	-0.092	0.524	0.185	-0.287	0.125	0.181	0.481
44	-0.258	0.018	0.011	-0.188	0.538	-0.014	-0.003	0.003	-0.213	0.439
45	-0.041	-0.254	-0.171	0.033	0.499	-0.057	0.316	0.208	0.048	0.434
46	0.070	-0.058	0.094	-0.149	0.633	-0.156	0.181	0.130	-0.249	0.576
47	0.248	0.141	-0.147	-0.209	0.608	0.177	0.153	-0.070	-0.061	0.580
48	0.030	-0.036	-0.097	-0.031	0.595	-0.036	0.025	-0.054	0.133	0.389
49	0.065	0.539	0.098	0.662	0.118	-0.055	0.079	0.001	0.107	0.346
50	-0.200	0.419	0.253	0.172	-0.110	-0.102	0.283	0.148	0.174	0.464
51	-0.042	0.571	0.333	0.150	-0.244	-0.195	0.008	0.021	-0.111	0.572
52	0.028	0.464	0.105	0.282	-0.078	-0.030	0.077	-0.146	-0.087	0.343
53	-0.078	0.473	0.064	-0.049	-0.392	-0.094	0.120	-0.169	0.058	0.445
54	0.041	0.349	-0.133	-0.000	-0.133	-0.474	-0.129	0.182	-0.215	0.480
55	0.069	0.024	0.159	0.201	0.122	0.340	0.531	-0.093	-0.079	0.499
56	-0.091	0.216	0.384	0.054	-0.067	-0.016	0.581	0.101	0.082	0.565
57	0.037	0.251	0.028	0.136	0.095	-0.017	0.376	-0.066	-0.013	0.239
58	-0.063	0.104	-0.169	-0.002	0.027	0.028	0.628	-0.028	0.364	0.573
59	-0.089	-0.212	0.002	0.065	0.118	0.063	0.470	0.170	-0.103	0.354
Variance Totals	3.566	3.199	3.170	3.070	2.932	2.807	2.647	2.616	2.627	26.662
Per cent of Common	13.37	12.09	11.90	11.52	11.00	10.53	9.94	9.93	9.86	109.09
Per cent of Total	6.04	5.42	5.37	5.20	4.96	4.76	4.49	4.48	4.45	45.15

Items as per Interview Schedule in Appendix A.

the Variable three items loaded highly on Factor 3 (interpreted as Variable one) and Factor 4 (interpreted as Variable 2, Knowledge of Child's Development). The latter two variables are somewhat related to Variable three. DEPVAR Variable two items did not load highly on any single factor however the highest loadings for these items are represented in Factor 4. Despite the few other items from different variables which loaded highly on Factor 4 it was assumed that this factor accounted for the DEPVAR Variable two items. Although DEPVAR Variable 7 (Dependency-Overprotection) items loaded highly on a number of factors they provided the only high loadings for Factor 8. In fact the highest DEPVAR Variable seven item loadings were present in Factor 8.

The one variable whose items did not show any clustering on any one factor was DEPVAR Variable six (Planfulness). The four significant item loadings were distributed over four factors. Likewise one of the factors, namely Factor 6, did not seem to represent any set of a priori assigned items. No doubt the items that loaded highly on Factor 6 did possess some common elements. However, they could not be interpreted in terms of the nine DEPVAR variables.

Summarizing from Table 4 we would say that the items representing DEPVAR Variables one, two, three, five, seven, eight, nine, and ten can be interpreted in terms of

Factors 3, 4, 9, 1, 8, 5, 2, and 7 respectively. DEPVAR Variable six and Factor 6 seem to be the only unexplainable pair. The conclusions reached from this analysis were that the original a priori clustering of items in the DEPVAR schedule, representing nine different home environment variables, were tenable.

Validity and Reliability of the DEPVAR

The data on the validity of the instrument, although usually included in this section, are being presented in conjunction with the analysis of data in a subsequent chapter. Results of the analysis which indicate to what extent the DEPVAR variables support the theory of dynamic process variables and the nature and degree of relationships that these variables have with differential mental abilities will contribute to the validity of the DEPVAR instrument. In a similar sense the reliability of the DEPVAR schedule will be indicated by the consistencies in the results for the replication of Groups 1 and 2.

Inter-rater reliability coefficients were calculated for the DEPVAR scale. These were based on two raters, the writer and an Educational Psychology doctoral student. The writer, and the student assisting in this phase of the study, spent a number of orientation sessions together discussing the Interview Schedule (Appendix A), the Rating Scale (Appendix B), and the Item Scoring Key (Appendix C).

Ultimately five interview protocols were selected randomly from the 100 subjects for the reliability check. Using the Item Scoring Key both the writer and his assistant rated independently the 59 items for protocols 110, 125, 221, 225, and 237. The scores for these five two-judge ratings were subjected to a one-way analysis of variance, repeated measures, on the 59 items (Winer, 1962, p. 124). The adjusted reliability coefficients for the five comparisons are shown in Table 5. The coefficients range from 0.817 to 0.917, which indicates that the DEPVAR scale can be reliably scored by different raters using the Item Scoring Key after a suitable training session.

TABLE 5

ADJUSTED INTER-RATER RELIABILITIES FOR DEPVAR

Protocol Case Number				
110	125	221	225	237
0.831	0.817	0.868	0.917	0.898
2 judges, 59 items rated				

OTHER INSTRUMENTS USED

Socio-economic Measures

The instrument used to measure the socio-economic level of the subjects was the revised Blishen Canadian Occupational Scale (Blishen, 1967) which is based on the 1961 census data. The reviewed form, in addition to considering the education and the income for ranking the occupations, also included the Pineo-Porter occupational scale, which is a "social standing" or "prestige" opinion measure of occupations, as a third basis for establishing the socio-economic ratings (Blishen, 1967). Since the original Pineo-Porter scale had ratings for only 88 occupations which were comparable to the 320 on the Blishen Scale, a regression equation was established on the basis of the 88 overlapping occupations. The equation, with appropriate weights for income and education, was then employed to obtain socio-economic scores for all the 320 occupations shown in Table I of the Blishen report (1967). This new scale correlates 0.96 with the original 1951 Blishen Scale. The data obtained from the Blishen Scale was called the Socio-Economic Score (SES), and was used in categorizing the samples into High and Low socio-economic groups, as well as in the analysis for testing some of the hypotheses.

Intelligence Measures

For the purpose of investigating relationships between environmental variables and intelligence, the different mental abilities were examined in terms of a structure which Burt (1949) called the intermediate or associative level. At this level mental ability is seen as consisting of a variety of factors: memory, association, imagery, verbal, numerical, practical, spatial, mechanical. This classification may be contrasted with the more recently developed higher relational or cognitive processes level. Wechsler (1958) interpreted mental ability factors as vectors of the mind, as modalities of mental functioning. In a factor analysis procedure the various intelligence scales or subtests lose their identity and are replaced by fewer "tests" or factors from which we can get a better account of how the mind really operates or, we are better able to define the abilities which are actually being measured. Depending on the types of ability tests used and the persons measured, the number of factors extracted may range from one to as many as there are tests. Guilford (Wechsler, 1958) in one of his studies proposed 40. Too many factors, of course, introduce the difficulty of assigning psychological meaning or interpretation to each factor. Seldom does the number of ability factors derived from a factor analysis of scores from batteries of intelligence tests go beyond 6 or 7, although the decision

of when to stop extracting common factors may depend on some imposed eigenvalue limits, the researcher's model, or his ability to interpret the factors.

After examining numerous mental ability tests it was decided that the complete WISC intelligence scale would provide an adequate measure of differential mental abilities. The WISC consists of twelve subtests which provide twelve scaled subtest scores, a Verbal IQ score, a Performance IQ score, and a Full Scale IQ score. It is designed for use with boys or girls ranging from five to fifteen years of age. The Verbal subtests are Information, Comprehension, Arithmetic, Similarities, Vocabulary, and Digit Span. The Performance subtests consist of Picture Completion, Picture Arrangement, Block Design, Object Assembly, Coding, and Mazes. The WISC is an individual test and requires about one and a half hours to administer under normal conditions. Although Wechsler obtained intercorrelations and reliability coefficients from his norming group for 7 1/2, 10 1/2, and 13 1/2 year old subjects we will present some of this information for the age relevant to this study, that is 10 1/2 years. Subtest intercorrelations ranged from .75 between Vocabulary and Information and between Vocabulary and Comprehension to .10 between Picture Completion and Digit Span. Comprehension and Vocabulary related highest to the Verbal score while Block Design showed the highest

relationship with Performance. The subtests correlating highest with Full Scale were Information at .77 and Vocabulary at .83. Of the Performance subtests Picture Arrangement and Block Design related highest to Full Scale in the order of .62 and .64 respectively. Reliability coefficients calculated by the split-half method and corrected for full length ranged from .91 for Vocabulary and .87 for Block Design to .59 for Digit Span on the subtests. The Verbal score (without Digit Span) reliability was .96, the Performance score (without Coding and Mazes) was .89, and the Full Scale (without Digit Span, Coding, and Mazes) was .95.

Although the environmental process variables were examined in relation to individual subtest scores, comparisons were also made with the ability factor scores, which were extracted through a factor analysis procedure. A number of studies that examined the WISC in terms of factor analysis procedures are presented in the following section.

Gault (1954), in a study in which he wished to compare the factorial structure of the WISC to the existing Adult Wechsler-Bellevue Scale, used all twelve subtests. By a rotated centroid method he extracted four major factors: I - general eductive, II - spatial perceptual, III - verbal comprehension, and IV - memory. These results

were nearly identical for both the 10 1/2 and 13 1/2 year groups. The loadings are shown in Table 6. Since the factor loadings on the WISC were comparable to those obtained by Hammer, as shown in Gault's (1954) report for the Adult Wechsler-Bellevue, and by Cohen (1956) for the WAIS, we may wonder whether there may also be two additional factors in the WISC which Cohen obtained in the WAIS. These two "new" factors, which seemed to lack reference abilities and clearcut implications of the tests which loaded under these factors, were referred to as: (a) resistance to distraction, and (b) appropriateness of responses. Cohen (1959) also carried out a WISC factor analysis on the data from the original standardization sample as reported in the WISC test manual. He extracted five primary oblique factors: Verbal Comprehension, Perceptual Organization, Free Distribution, Verbal Comprehension II, and Quasi-Specific. He also obtained a second order factor which accounted for about one third of the total variance. Maxwell (1960) used a British sample of 7 1/2, 10 1/2, and 13 1/2 year old boys and girls. He analyzed the results of ten WISC subtests (excluding Information and Maze) and the Verbal and Performance Scores by the centroid method. After rotation he obtained two major factors at all age levels. For the 10 1/2 year old subjects Factors I and II accounted for 47.9 and 6.0 per cent of the total variance respectively. After examining the loadings, Factor I was interpreted as

TABLE 6

ROTATED FACTOR LOADINGS OF TWO AGE LEVELS OF THE WECHSLER INTELLIGENCE SCALE FOR CHILDREN

Subtest	Age 10 1/2				Age 13 1/2				h^2
	I	II	III	IV	I	II	III	IV	
Information	69	-07	48	21	69	-03	51	10	74
Comprehension	65	-01	44	15	54	-09	48	01	53
Arithmetic	57	04	31	42	53	-11	36	30	50
Similarities	58	-09	43	22	66	05	48	03	66
Vocabulary	75	08	42	18	66	01	51	01	70
Digit Span	34	11	10	55	39	-08	25	24	28
Picture Completion	57	31	15	-17	49	49	09	-01	47
Picture Arrangement	51	12	22	34	51	33	00	38	52
Block Design	61	49	00	22	60	56	11	-02	69
Object Assembly	49	51	-02	16	49	55	00	06	54
Coding B	33	05	16	38	43	13	14	24	28
Mazes	50	42	00	13	44	17	-01	55	53
Mean Contribution to Variance (%)	32	7	8	8	30	9	10	6	55

Decimal points omitted.

(Gault, 1954, p. 87)

verbal-intellectual (vg) and Factor II as space-performance (sp). Jones (1962), although actually carrying out a factor analysis with 8, 9, and 10 year old boys and girls to determine whether the twelve WISC subtests are saturated with a common factor, also found two factors for all age levels. No rotation was carried out. A factor analysis of WISC and socio-economic scores for 10 and 12 year old boys and girls was performed by Cropley (1963). In the unrotated form he obtained four common factors. Factor I was considered the general factor, Factor II a socio-economic factor, Factor III a manipulatory-organizational aspect, and Factor IV a perceptual organization factor.

In this study, the scaled WISC subtest scores and the three IQ scores, as well as the intelligence factor scores, were examined for relationships with environmental factor scores and DEPVAR variable scores.

CHAPTER IV

PROCEDURE AND DESIGN

SAMPLING AND DATA GATHERING PROCEDURE

Selecting the Sample

The objectives of this study were to identify and measure the differential aspects of the home environment in a sample which included the high and the low traditional socio-economic status levels and relate these environmental aspects to the various levels and patterns of mental ability. A decision was made to use, as a sample source, the urban community of Edmonton which has a population of about 500,000. It was necessary to obtain a sample of homes for the study which would provide; a wide range of home environments as measured by the DEPVAR, a full range of conventional socio-economic levels, and subjects with a full range and variety of patterns of mental abilities. After examining Kupfer's (1967) community assessment study two general areas of the city were considered. These two areas represented the highest and the lowest levels on three of Kupfer's variables namely income, education, and occupation. It was assumed that the whole urban area had similar educational opportunities and programs. Consequently, the educational factor would not be a source of variance in the environmental measures for the homes from the two areas.

In selecting the sample age a number of considerations had to be examined. The age level had to be such that the overall mental ability is nearly fully developed and differentiation of mental abilities is at such a stage where different ability patterns can be detected. Wolf (1964a) summarized some research which indicated that 80 to 90 per cent of mature intelligence is developed by age eleven. Dockrell (1966), Orpet and Meyers (1966), and Maxwell (1960) have shown that some differentiation of abilities is evident at age six and that at ages ten or eleven there are some distinct factors emerging. On the other hand, the age of the sample subjects also had to be such that the present home environmental influence was still powerful and the early influences were not largely replaced by other more powerful effects. Wolf (1964a) stated that at about the age of eleven the home influence is still dominant and the peer group plays a secondary role in the life of an eleven year old child. On the strength of such evidence it was decided to select, for this study, Grade 4 boys who are approximately ten years of age. The decision to use boys only for the sample is supported by a number of studies. Schaefer and Bayley (1963) concluded that the long-term effects of upbringing are more clearcut for boys than for girls. Also, since Honzik (1967) found quite divergent results in environmental influences on ability for boys and for girls, it would have

been necessary to study the two sexes individually, thus requiring a larger sample for maintaining similar rigors. Finally, as stated earlier, the responses by the mother, with regard to the dynamic characteristics in the home, may be more valid and less biased when discussing a boy in the family than a girl. Consequently the sample for this study was one hundred homes, where both parents were alive and living together, where English was at least one of the languages spoken, and which had a boy in Grade 4.

When the decision was reached on the nature of the sample a list of all the Grade 4 boys was obtained from the public and separate schools in the two selected sections of the city. The families from the "low" and the "high" areas were assigned random numbers. Starting at the beginning of each of these two lists the families were contacted by telephone where they were informed about the purpose and nature of the study and asked to cooperate in the project. The first fifty families from each of the "high" and "low" areas who agreed to take part in the study became the subjects for the sample. A total of sixty contacts had to be made in the "high" area and seventy in the "low" to obtain the fifty families from each of the two areas.

After obtaining a detailed description of the fathers' occupations the one hundred families were assigned a Blishen socio-economic score (SES) and ranked on the basis of these scores. From these one hundred families two

matched samples of fifty each were formed -- Group 1 as the basic sample and Group 2 as the replication sample.

Some of the characteristics of the one hundred families in terms of the whole group as well as on the basis of the Group 1 and Group 2 samples of fifty each are presented in Table 7. A summary of the means and standard deviations for the sample categorized on the basis of socio-economic scores is also given in this table.

Collection of the Data

During the original telephone contact the families were informed about what was expected from them in terms of time and information. They were instructed that the data collection would consist of two stages: (1) a one-and-a-half hour focused interview with the mother to obtain information about the home environment, and (2) the administration of an individual ability or skill test to their Grade 4 boy. The families were informed that there would be a number of persons assisting the writer in the data collection and that strict confidentiality as well as full consideration for the privacy of the home and family would be maintained.

The first stage of the data collection consisted of the interviews with the mothers. Two graduate students, recommended by faculty members, assisted the writer in getting the one hundred interviews. The two assistants

TABLE 7

SAMPLE MEANS AND STANDARD DEVIATIONS FOR AGE,
SOCIO-ECONOMIC SCORES, AND WISC FULL IQ

	A G E		S E S		WISC FULL IQ	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Grp. 1 N=50	117.86	5.24	48.94	17.54	113.14	11.90
Grp. 2 N=50	118.14	5.15	48.87	17.25	112.74	12.35
Grp. 12 N=100	118.00	5.17	48.91	17.31	112.94	12.07
Grp. 1 High SES N=25	116.28	3.43	64.60	9.71	117.84	9.53
Grp. 1 Low SES N=25	119.44	6.25	33.29	4.87	108.44	12.33
Grp. 2 High SES N=25	117.96	5.01	64.12	9.80	116.64	10.18
Grp. 2 Low SES N=25	118.32	5.39	33.62	5.20	108.84	13.27
Grp. 12 High SES N=50	117.12	4.34	64.36	9.66	117.24	9.78
Grp. 12 Low SES N=50	118.88	5.81	33.46	4.99	108.64	12.68

were initially involved in the pilot study. Prior as well as subsequent to the pilot run, the writer and the two students held a number of training sessions on interviewing procedures and techniques in general, and on the specific use of the DEPVAR Interview Schedule.

Appointments were made with the mothers to have the interviews at their home preferably at such times when no other members of the family were present during the interview. Upon entry into the home the interviewer established rapport by discussing the general aspects of the study. Following this introduction the interview, which required between one and one-and-a-half hours, was held in accordance with the DEPVAR Interview Schedule. The interviewers, just as the protocol scorer, had no knowledge of the boys' abilities at the time of the home interviews. Except for some questions about what goes on in the home generally the DEPVAR items were directed at identifying and measuring behaviors and interaction relevant to the 10 year old boy. The proceedings of the entire interview were recorded on tape and were subsequently transcribed to facilitate scoring.

During the mother interview the following additional information was obtained: (1) description of the father's occupation, (2) formal education of mother and father, (3) the number of children in the family and the birth

order of the Grade 4 boy, (4) language(s) other than English spoken in the home and by whom. Some of these data were used in the study whereas the remaining information may have some value in any follow-up studies that may be considered.

The second half of the data collection was the administration of the complete WISC battery of twelve subtests to the one hundred boys by four Educational Psychology graduate students. Certification as to the high level and uniformity in experience, training, and skill of the testers in administering WISCs was provided by the Director of Psychological Assessment for the Department of Educational Psychology, University of Alberta. Appointments were made to test the boys either at home or in their respective schools, depending on whichever setting appeared to be more appropriate for the optimum performance by the boy. All the schools were cooperative in providing testing facilities outside school hours whenever the testing was done in school. In all cases where subjects were tested at home a quiet room with no distracting influences was provided. An honorarium of one dollar was given to each of the one hundred boys tested for this study.

TREATMENT OF THE DATA

The Blishen Socio-Economic Scores (SEs), as mentioned earlier, were used in the initial breakdown of the total sample of one hundred into two similar groups of fifty subjects each. The scores were subsequently used in the major analysis of the data to test some of the hypotheses. In one instance the SEs were used to divide the groups into High and Low socio-economic status groups. These two status groups were then compared with respect to their relationships between WISC Full IQ scores and DEPVAR variable and factor scores. For another hypothesis an analysis was performed to see whether the ten individual DEPVAR variable scores differed for the High and the Low socio-economic status groups.

The twelve WISC subtest scores as well as the Verbal, Performance, and Full IQs were all used in the analyses. Principal Axes factor analyses were performed on the subtests and an appropriate number of factors with meaningful rotations was selected for interpretation. The selected factor loadings were then used, in conjunction with the original subtest scores, to generate factor scores for all the sample subjects.

The data from the DEPVAR Interview Schedule consisted of 59 item scores and 10 variable scores for each subject. The item scores were used to validate the

a priori clustering of items for nine of the variables, and to estimate the inter-judge scoring reliability. The 10 DEPVAR variable scores, nine of which were obtained by clustering the 59 items, were factor analyzed by the Principal Axes method. Again, as with the WISC analyses, the appropriate numbers of factors and suitable rotations were selected. Factor scores for the environment measures were likewise generated and used in the analyses in much the same way that the 10 DEPVAR variable scores were.

CHAPTER V

ANALYSIS AND RESULTS

DIFFERENTIAL ENVIRONMENT MEASURES

The preceding chapters provided a detailed verbal description of the variables used in this study as well as a general explanation of the treatment of the data. This chapter explains the entire analyses used with the data for obtaining information about the variables used in testing the hypotheses presented in Chapter II. The results are being presented for: (a) Group 1 which is the principal sample for the study (N=50), (b) Group 2, which is the replication sample (N=50), and (c) Group 12 which consists of the combined Group 1 and 2 samples (N=100).

Differential Environmental Process Variables

Having obtained the DEPVAR variable scores by the method described in Chapter III, means and standard deviations for the 10 variables were calculated. Examination of Table 8 shows that the variable means for Group 1 ranged from 3.91 to 4.81. The standard deviation, except for the one imposed by standardization for Variable four (Language Model), ranged from 0.47 to 0.89. Inspection of the table also revealed that Group 1 and Group 2 have very similar means and standard deviations for the same variables. Group 12, by virtue of the fact that it is the sum of Group 1

TABLE 8

DEPVAR VARIABLE MEANS AND STANDARD DEVIATIONS FOR
GROUPS 1, 2, AND 12

DEPVAR Vari- ables	Grp. 1 (N=50)		Grp. 2 (N=50)		Grp. 12 (N=100)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
1	4.53	0.71	4.45	0.75	4.49	0.73
2	4.81	0.83	4.79	0.75	4.80	0.79
3	4.06	0.74	4.02	0.62	4.04	0.68
4	4.03	1.22	4.12	1.46	4.08	1.35
5	4.07	0.89	4.02	0.70	4.04	0.80
6	4.19	0.58	4.34	0.55	4.26	0.57
7	3.91	0.47	3.97	0.49	3.94	0.48
8	4.03	0.57	4.19	0.59	4.11	0.59
9	4.22	0.60	4.14	0.62	4.18	0.61
10	4.07	0.79	4.10	0.80	4.09	0.80

DEPVAR Variables

- 1 - Academic and Vocational Aspirations and Expectations of Parents
- 2 - Knowledge of, and Interest In, Child's Academic and Intellectual Development
- 3 - Material and Organizational Opportunities for the Use and Development of Language
- 4 - Quality of Language in the Home
- 5 - Female Dominance in Child Rearing
- 6 - Planfulness, Purposefulness, and Harmony in the Home
- 7 - Dependency Fostering - Overprotection
- 8 - Authoritarian Home
- 9 - Interaction with Physical Environment (Visual and Kinaesthetic Experiences)
- 10 - Opportunity for, and Emphasis on, Initiating and Carrying Through Tasks

and Group 2 has variable means and standard deviations falling somewhere between the two groups.

Pearson product-moment intercorrelations among the DEPVAR variables were quite revealing. Examining the correlations for Group 1 in Table 9 we find that the Overprotection-Dependency (7), the Authoritarian (8), and the Female Dominance (5) variables relate negatively to all of the other seven variables. Although the division of positive and negative correlations is not as definite for Group 2 the pattern of intercorrelation is predominantly the same. The pattern for Group 12 resembles Group 1 a little more than it resembles Group 2. The highest relationships for all three groups are between Variables one and three (Aspirations and Expectations; Opportunity for Language Development). Variable six (Planfulness) shows significant relationships with Variables one, two (Knowledge of Child's Development), and three consistently in all three groups. Hypothesis 1 stated that the DEPVAR would measure home environments differentially. Evidence to partially support this hypothesis lies in the degree of replication of the intercorrelation patterns in Group 1 and Group 2. This tells us that the instrument is measuring similar characteristics, which are represented by the variables, in much the same way in two independent groups. The fact that the correlations among the DEPVAR variables are low is additional support for Hypothesis 1 and for the differential nature of the DEPVAR

TABLE 9

DEPVAR VARIABLE INTERCORRELATION COEFFICIENTS FOR
GROUPS 1, 2, AND 12

		DEPVAR Variables Grp. 2 (N=50)										
		1	2	3	4	5	6	7	8	9	10	
DEPVAR Variables Grp. 1 (N=50)	1		265	562	323	-102	419	-156	-308	215	128	1
	2	448		410	232	-424	376	-237	-093	271	293	2
	3	550	443		277	-232	385	-048	-308	119	308	3
	4	224	185	305		014	-031	-070	-176	315	-059	4
	5	-342	-243	-292	196		-236	112	-011	070	-233	5
	6	449	356	370	324	-311		-243	-212	216	207	6
	7	-020	-223	-282	-227	144	-001		482	-377	005	7
	8	-136	-312	-325	-318	215	-255	351		-187	295	8
	9	316	458	462	335	-217	204	-375	-251		046	9
	10	148	177	321	000	-059	076	-158	017	431		10
		1	2	3	4	5	6	7	8	9	10	
		Grp. 1										

Grp. 2

Critical r for 0.05 level = ± 0.278 ; for 0.01 level = ± 0.360

DEPVAR Variables Grp. 12 (N=100)	1											
	2	361										
	3	558	433									
	4	280	210	288								
	5	-229	-320	-269	104							
	6	426	364	372	137	-280						
	7	-095	-231	-174	-138	128	-113					
	8	-232	-206	-319	-234	109	-213	427				
	9	269	371	306	324	-083	202	-381	-225			
	10	138	235	316	-032	-138	145	-072	164	235		
		1	2	3	4	5	6	7	8	9	10	
		DEPVAR Variables Grp. 12										

Critical r for 0.05 level = ± 0.197 ; for 0.01 level = ± 0.257

Decimal points omitted.

DEPVAR Variable designations as in Table 8, page 82.

instrument.

To summarize the various relationships in Table 9 an orthogonal Principal Axes (Harman, 1967, p. 135) factor analysis was performed using the DEPVAR intercorrelations. Examining the eigenvalue plots (Figure I), as well as using the rule of "eigenvalues greater than 1" (Harman, 1967, p. 198), four factors were extracted for each of the three groups. To equalize the variance accounted for by the four factors orthogonal Equamax rotations were performed on Groups 1, 2, and 12. In addition to the Equamax rotation a Kaiser factor match rotation was performed on the Group 2 loadings (Kaiser, 1960). The Kaiser rotation was obtained when the Group 2 Equamax was rotated to the Group 1 Equamax (Table 10) as the target. It was this rotation that was used for subsequent Group 2 (Table 11) analyses. For Group 1 and Group 2 the four factors accounted for 71.62 and 69.84 per cent of the total variance respectively with each factor accounting for the amounts shown in Tables 10 and 11.

By considering arbitrarily, loadings of 0.300 as meaningful contributions (Fruchter, 1954, p. 151, considers loadings of 0.300 as moderate), an interpretation of the factors as aspects of the home environment for Group 1 was made. Factor 1 (Table 10) seems to represent a home where parents aspire and plan for future achievements and events with respect to themselves and their children. It is a

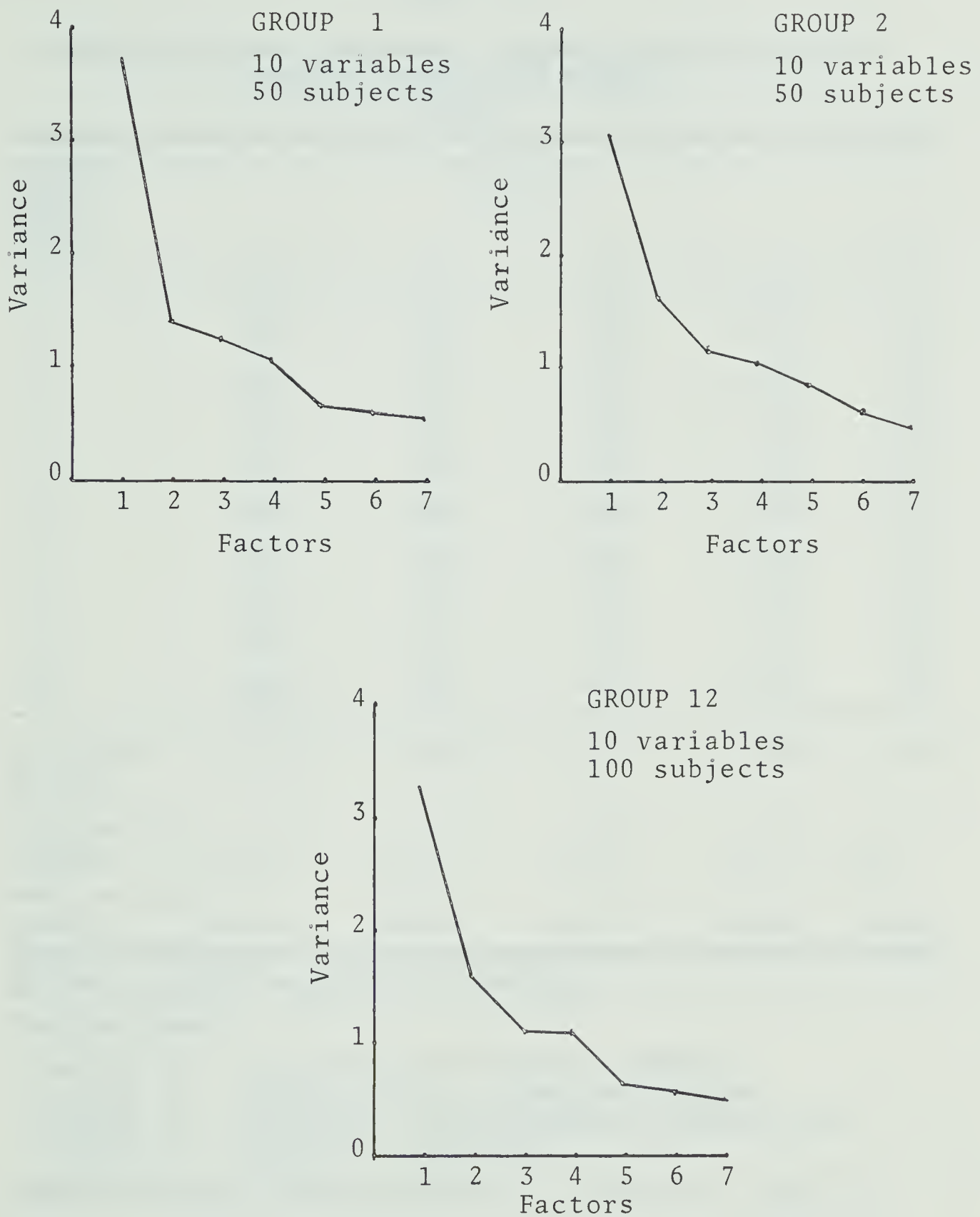


FIGURE I

EIGENVALUE PROFILES FOR THE DEPVAR VARIABLE PRINCIPAL
AXES FACTOR ANALYSES FOR GROUPS 1, 2, AND 12

TABLE 10

DEPVAR VARIABLE ORTHOGONAL EQUAMAX ROTATION FACTOR
LOADING MATRIX FOR GROUP 1
(N=50)

DEPVAR Vari- ables	Factors				h ²
	1	2	3	4	
1	807	017	245	-076	717
2	537	-321	335	-063	508
3	576	-303	470	009	645
4	354	-346	060	779	856
5	-411	286	-042	762	833
6	804	-098	-036	061	661
7	177	784	-326	001	752
8	-242	797	103	-052	708
9	246	-374	703	097	704
10	-003	100	875	-043	778
Variance Totals	2.362	1.807	1.777	1.215	7.162
Per cent of Common	32.96	25.25	24.82	16.97	100.0
Per cent of Total	23.62	18.07	17.77	12.15	71.62

Decimal points omitted in loadings.

Designations:

Factor 1 -- Aspiration-Planfulness-Harmony
Factor 2 -- Authoritarian - Overprotective
Factor 3 -- Activity - Environmental Interaction
Factor 4 -- Female - Language

DEPVAR Variable designations as in Table 8, page 82.

TABLE 11

DEPVAR VARIABLE ORTHOGONAL EQUAMAX-KAISER MATCH
 ROTATION TO GROUP 1 EQUAMAX AS TARGET FACTOR
 LOADING MATRIX FOR GROUP 2
 (N=50)

DEPVAR Vari- ables	Factors				h ²
	1	2	3	4	
1	793	045	-200	208	713
2	391	641	-229	-186	651
3	868	151	-047	043	780
4	306	320	-106	734	746
5	-305	-331	035	570	522
6	535	170	-350	-363	569
7	054	-172	860	144	792
8	-347	367	741	-108	815
9	-055	564	-544	379	760
10	249	617	303	-316	634
Variance Totals	2,196	1,540	1,906	1,351	6,990
Per cent of Common	31.40	22.05	27.28	19.35	100.0
Per cent of Total	21.96	15.40	19.06	13.51	69.90

Decimal points omitted in loadings.

Designations:

- Factor 1 -- Aspiration-Planfulness-Harmony
- Factor 2 -- Activity-Environmental Interaction
- Factor 3 -- Authoritarian-Overprotective
- Factor 4 -- Female-Language

DEPVAR Variable designations as in Table 8, page 82.

harmonious home with considerable opportunities for academic and language development and an absence of excessive authority or female domination. In short this could be called an Aspiration-Planfulness-Harmony factor (1). The second factor is one which represents an environment where authority rules and where dependency is fostered. The negative loadings for DEPVAR Variables two, three and nine (Knowledge of Child's Development; Opportunity for Language Development; Environmental Interaction) show that there is a lack of opportunity for academic development as well as for environmental interaction. This factor will be called an Authoritarian-Overprotective aspect (2). Loadings on the third factor (Table 10) suggested an environment where there is ample opportunity for environmental interaction and activity in general. There would be freedom to explore and an absence of an overprotective atmosphere. This is labelled as an Activity-Environmental Interaction factor (3). Only two variables load on the fourth factor. These are the mother Language Model and the Female Dominance variables. This would have to be some aspect of the environment which involves the mother, her domination, and her influence as a language model. This characteristic will be referred to as the Female-Language factor (4).

To get further evidence of the consistency of the DEPVAR in evaluating the home environments a Kaiser (1960) factor match was performed with the Group 2 factor structure.

Using Group 1 Equamax (Table 10) as a target the best possible rotation of the Group 2 Equamax was obtained. This matrix, shown in Table 11, was accepted as the Group 2 replication factor loading matrix. The cosine values between the Group 1 and Group 2 factors in Tables 10 and 11 are shown in Table 12. The values suggest that Group 1 Factors 1, 2, 3, and 4 resemble Group 2 Factors 1, 3, 2, and 4 respectively. Examining the Group 2 Factor 1 loadings on the basis of 0.300 or higher we find that DEPVAR Variables 1, 2, 3, 4, 5, and 6 (Table 11) are common with the Group 1 Factor 1 and that Factor 1 in both Groups accounts for the same type of environmental characteristic. As Table 12 illustrates, the Group 2 Factor 2 axis is close to the Group 1 Factor 3 axis. Loadings for Variables 2, 9, and 10 (Knowledge of Child's Development; Environmental Interaction; Completing Tasks) are common for Group 2 Factor 2 and Group 1 Factor 3. Negative loadings by the Female Dominance and Overprotective variables also add support to naming the Group 2 Factor 2 an Activity-Environmental Interaction aspect. In considering Group 2 Factor 3 and Group 1 Factor 2 we notice that loadings for Variables 7, 8, and 9 (Dependency-Overprotection; Environmental Interaction; Completing Tasks) are common. That Factor 3 for Group 2 can be referred to as the Authoritarian-Overprotective aspect is further substantiated by a significant negative loading on the Planfulness variable (6). According

TABLE 12

KAISER ROTATED DEPVAR COSINE VALUES BETWEEN THE GROUP 1 EQUAMAX ORTHOGONALLY ROTATED SOLUTION AS THE TARGET AND THE GROUP 2 EQUAMAX ORTHOGONALLY ROTATED SOLUTION

Group 2 Reference Axes (N=50)	Group 1 Reference Axes (N=50)			
	1	2	3	4
1	969	-050	-174	166
2	243	083	749	-610
3	023	967	082	241
4	-024	237	634	736

Decimal points omitted.

Group 1 Factor Designations:

- 1 -- Aspiration-Planfulness-Harmony
- 2 -- Authoritarian-Overprotective
- 3 -- Activity-Environmental Interaction
- 4 -- Female-Language

Group 2 Factor Designations:

- 1 -- Aspiration-Planfulness-Harmony
- 2 -- Activity-Environmental Interaction
- 3 -- Authoritarian-Overprotective
- 4 -- Female-Language

to the factor match, Factor 4 in both groups represents the Female-Language aspect. The common DEPVAR variables are 4 and 5 (Language Model; Female Dominance).

The comparison points out that the DEPVAR variables could be clustered in a similar way for two independent samples and enable the environmental characteristics to be interpreted in terms of four corresponding factors for the

two groups. In considering the full sample, that is Group 12, we find from Table 13 that, with the exception of the loading of Variable 4 (Language Model) on Factor 1 in Group 12, all the variables that were common to Group 1 and Group 2 on corresponding factors are also common to Group 12.

The results of the variable intercorrelations and the factor analyses of the DEPVAR data give fundamental support to Hypothesis 1 in terms of the ability of the instrument to measure reliably and differentially, with different groups, certain postulated characteristics of home environments. Subsequent analyses which will involve comparisons between these environmental characteristics and different mental abilities will contribute to the validity aspects of the instrument as well as test Hypotheses 2, 3, and 4.

Wechsler Intelligence Scale for Children

To be able to make meaningful comparisons between environmental variables and mental abilities a complete analysis of the WISC data was made for the three groups. Although the WISC is a standardized and proven scale, because our sample is not necessarily representative of the norming population, we will present the results of the WISC data for the three groups used in this study.

The published norms for the WISC give scaled means

TABLE 13

DEPVAR VARIABLE ORTHOGONAL EQUAMAX ROTATION
 FACTOR LOADING MATRIX FOR GROUP 12
 (N=100)

DEPVAR Vari- ables	Factors				h^2
	1	2	3	4	
1	785	-044	094	231	680
2	527	-316	385	-012	526
3	702	-182	297	178	647
4	272	-175	008	790	728
5	-498	210	-117	626	698
6	720	-103	062	-074	538
7	060	877	-152	020	795
8	-304	716	341	-125	737
9	125	-522	512	352	675
10	098	081	877	-088	794
Variance Totals	2.348	1.781	1.434	1.254	6.817
Per cent of Common	34.48	26.14	21.02	18.40	100.0
Per cent of Total	23.48	17.81	14.34	12.54	68.17

Decimal points omitted in loadings.

Designations:

- Factor 1 -- Aspiration-Planfulness-Harmony
- Factor 2 -- Authoritarian-Overprotective
- Factor 3 -- Activity-Environmental Interaction
- Factor 4 -- Female-Language

DEPVAR Variable designations as in Table 8, page 82.

of 10 and standard deviations of 3 for the subtests and means of 100 and standard deviations of 15 for the three IQs. It is apparent from Table 14 that our samples have mean IQ as well as mean subtest scores which are well above the WISC norms. The standard deviations, particularly for the subtests are in the order of the test publisher's values. With the exception of the Verbal IQ standard deviation for Group 2 being considerably different from the Group 1 standard deviation, there do not seem to be any outstanding differences in means or standard deviations between the two groups.

Examining the correlations in Tables 15 and 16 we notice that the subtest intercorrelations ranged from $-.061$ to $.700$. In comparing Group 1 with Group 2 on the basis of subtest interrelationships about 15 of the 66 comparisons differed substantially. The IQ intercorrelations come up to the published coefficients. Just as in the subtests, where the Verbal-Performance correlations were generally lower for Group 2 than for Group 1, the Verbal-Performance IQs are less related for Group 2 than they are for Group 1.

Just as for the DEPVAR variables a Principal Axes factor analysis was performed on the WISC subtest scores. After examining the eigenvalue plots in Figure II and considering the "eigenvalues greater than 1" rule (Harman, 1967, p. 198), a decision was made to extract four factors for each of the three groups. For interpretation of the

TABLE 14

WISC SUBTEST AND VERBAL, PERFORMANCE, AND FULL IQ
MEANS AND STANDARD DEVIATIONS FOR GROUPS 1, 2, AND
12

WISC Subtests	Grp. 1 (N=50)		Grp. 2 (N=50)		Grp. 12 (N=100)	
	Means	S.D.	Means	S.D.	Means	S.D.
1	11.46	2.60	11.14	2.76	11.30	2.67
2	12.02	2.90	12.42	3.41	12.22	3.16
3	11.62	2.28	11.46	2.22	11.54	2.24
4	13.04	3.11	12.68	3.55	12.86	3.33
5	12.86	2.76	12.30	3.65	12.58	3.23
6	10.28	2.26	9.64	2.39	9.96	2.34
7	12.06	2.91	11.74	3.06	11.90	2.98
8	11.42	2.56	10.98	2.81	11.20	2.68
9	11.64	3.01	11.96	2.70	11.80	2.85
10	11.92	3.02	11.70	3.36	11.81	3.18
11	11.30	2.31	11.80	2.76	11.55	2.55
12	11.26	2.83	11.86	2.61	11.56	2.73
V IQ	112.44	11.97	110.88	14.29	111.66	13.14
P IQ	111.60	11.69	112.50	12.04	112.05	11.82
F IQ	113.14	11.90	112.74	12.35	112.94	12.07

Designation:

- | | |
|--------------------|-------------------------|
| 1 - Information | 7 - Picture Completion |
| 2 - Comprehension | 8 - Picture Arrangement |
| 3 - Arithmetic | 9 - Block Design |
| 4 - Similarities | 10 - Object Assembly |
| 5 - Vocabulary | 11 - Coding |
| 6 - Digit Span | 12 - Mazes |
| V - Verbal IQ | |
| P - Performance IQ | |
| F - Full Scale IQ | |

TABLE 15

WISC SUBTEST AND VERBAL, PERFORMANCE, AND FULL IQ INTERCORRELATION COEFFICIENTS
FOR GROUPS 1 AND 2

		Grp. 2 (N=50)														
		1	2	3	4	5	6	7	8	9	10	11	12	V	P	F
Grp. 1	1		550	539	575	543	308	321	134	283	328	053	069			
	2	535		154	476	670	293	278	093	317	093	200	164			
	3	480	482		466	270	330	354	272	191	161	-037	-061			
	4	505	376	338		700	250	345	286	331	310	228	006			
	5	472	554	252	578		290	361	213	316	169	216	-029			Grp. 2
	6	462	213	121	064	173		203	118	274	094	-014	059			
	7	446	535	073	276	476	259		078	401	232	318	100			
	8	164	279	127	144	229	066	241		111	262	164	030			
	9	418	402	357	379	466	268	352	251		441	265	394			
	10	247	253	106	515	461	085	169	110	439		356	308			
	11	443	368	223	237	385	286	291	290	245	326		246			
	12	264	109	155	008	114	035	136	015	043	124	284				
		V													409	865
		P												637		776
		F												900	879	
												Grp. 1 (N=50)				

Critical r for 0.05 level = +0.278; for 0.01 level = +0.360.
Decimal points omitted.
WISC Subtest designations as in Table 14, page 95.

TABLE 16
WISC SUBTEST AND VERBAL, PERFORMANCE, AND FULL IQ INTERCORRELATION COEFFICIENTS
FOR GROUP 12 (N=100)

Grp. 12															
	1	2	3	4	5	6	7	8	9	10	11	12	V	P	F
1															
2	542														
3	515	306													
4	550	433	409												
5	518	620	264	655											
6	388	248	232	173	251										
7	386	392	219	319	413	237									
8	153	169	079	228	227	105	159								
9	350	361	279	352	374	262	374	177							
10	295	161	137	406	291	095	206	198	439						
11	220	277	080	227	273	104	301	211	259	341					
12	161	144	049	001	026	032	113	013	209	213	272				
V															
P													512		
F													887	833	

Critical r for 0.05 level = +0.197; for 0.01 level = +0.257.
Decimal points omitted.
WISC Subtest designations as in Table 14, page 95.

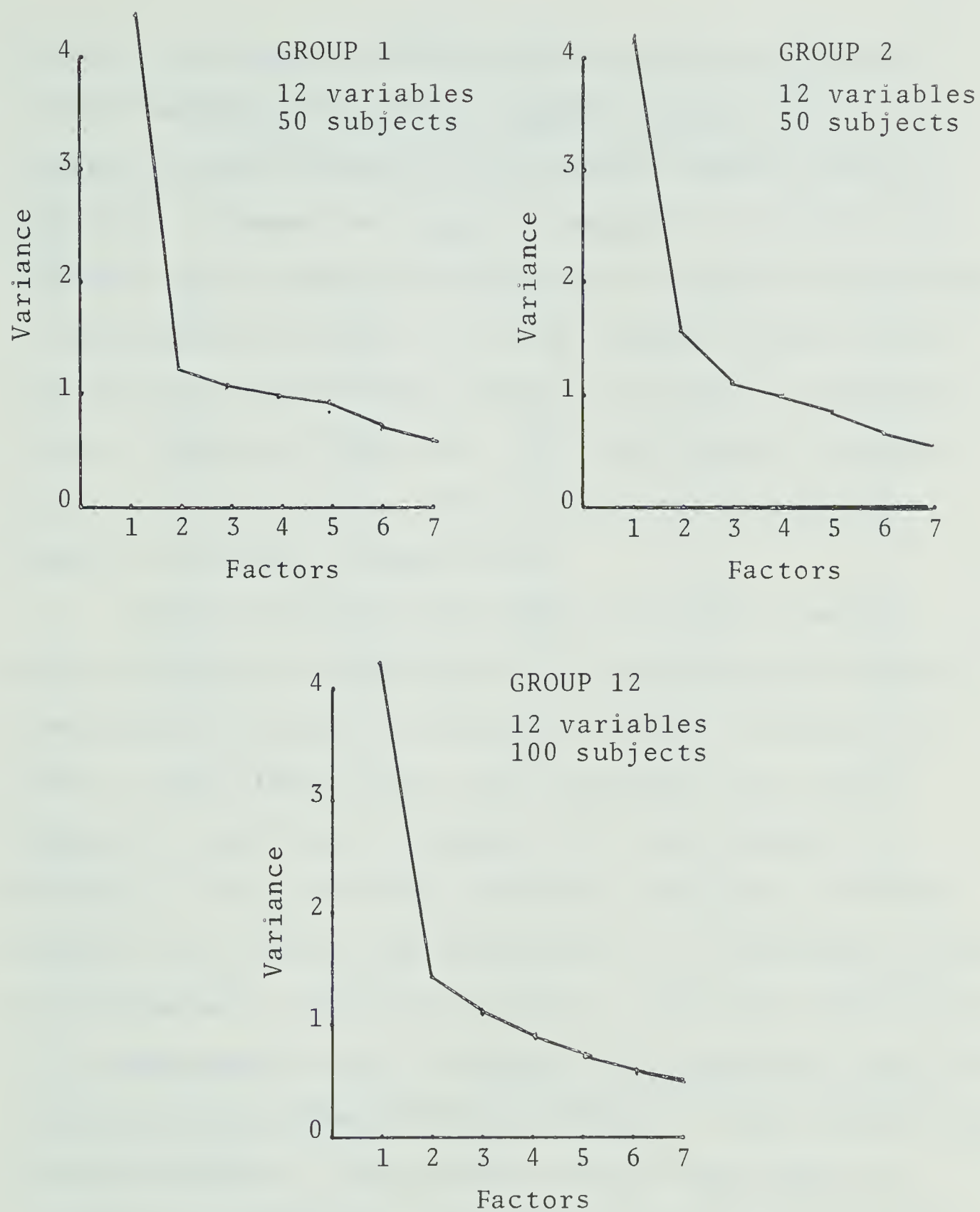


FIGURE II

EIGENVALUE PROFILES FOR THE WISC SUBTEST PRINCIPAL
AXES FACTOR ANALYSES FOR GROUPS 1, 2, AND 12

factors, orthogonal Varimax rotations were selected for Group 1 and Group 12 and the Equamax rotation for Group 2. Similar to the treatment of the Group 2 DEPVAR analysis the Group 2 Equamax was again orthogonally rotated using a Kaiser factor match procedure which considered the Group 1 Varimax matrix (Table 17) as the target (Kaiser, 1960). This Kaiser rotated factor matrix was used for subsequent Group 2 analyses (Table 18). The four factors accounted for 65.10 and 66.30 per cent of the total variance for Group 1 and Group 2 respectively.

Again loadings in the order of 0.300 or better were considered as meaningful in interpreting the factors. Examining the Varimax rotation for Group 1 we notice in Table 17 that Similarities (4), Vocabulary (5), Block Design (9), and Object Assembly (10) load heaviest on Factor 1. In terms of the items and responses for these subtests, the factor was interpreted as a Reasoning ability. The predominant loadings for Factor 2 came from Information (1), Comprehension (2), Arithmetic (3), and Digit Span (6). This factor was labelled General Memory. This includes long and short memory. Block Design (9) and Digit Span (6) could be cases of short memory while the other variables loading highly on this factor could be classified as long-term memory ability. Factor 3 was considered to be a type of a Verbal-Symbolic ability. Performance on the eight subtests, indicated in Table 17, which load heavily on this

TABLE 17

WISC SUBTEST ORTHOGONAL VARIMAX ROTATION FACTOR
LOADING MATRIX FOR GROUP 1 (N=50)

WISC Sub- tests	Factors				h^2
	1	2	3	4	
1	251	719	320	281	762
2	334	564	447	046	631
3	210	825	-149	066	751
4	786	327	048	-037	728
5	673	252	403	094	687
6	-212	473	475	095	502
7	194	210	716	086	601
8	151	-069	646	-016	445
9	511	386	329	-073	523
10	821	-058	084	209	729
11	233	169	454	569	613
12	016	097	-061	905	833
Vari- ance Totals	2.384	2.149	1.969	1.305	7.807
Per cent of Common	30.55	27.53	25.21	16.72	100.00
Per cent of Total	19.88	17.90	16.40	10.88	65.10

Decimal points omitted.

Designations:

Factor 1 --Reasoning

Factor 2 --General Memory (long and short term)

Factor 3 --Verbal-Symbolic

Factor 4 --Perceptual-Motor-Spatial

WISC Subtest designations as in Table 14, page 95.

TABLE 18

WISC SUBTEST ORTHOGONAL EQUAMAX-KAISER MATCH ROTATION
TO GROUP 1 VARIMAX AS TARGET FACTOR LOADING MATRIX FOR
GROUP 2
(N=50)

WISC Sub- tests	Factors				h ²
	1	2	3	4	
1	276	674	-060	375	675
2	783	463	090	015	836
3	-249	742	-148	387	784
4	457	457	-149	550	743
5	733	452	-132	287	841
6	-011	608	059	143	394
7	162	425	278	343	402
8	182	-264	-219	736	692
9	160	350	627	340	657
10	-031	023	427	717	697
11	426	-228	427	396	573
12	078	009	808	055	661
Variance Totals	1.771	2.428	1.613	2.145	7.955
Per cent of Common	22.28	30.55	20.28	26.95	100.00
Per cent of Totals	14.75	20.23	13.43	17.87	66.30

Decimal points omitted.

Designations:

- Factor 1 -- Verbal-Symbolic
- Factor 2 -- General Memory (long and short term)
- Factor 3 -- Perceptual-Motor-Spatial
- Factor 4 -- Reasoning

WISC Subtest designations as in Table 14, page 95.

factor, require some symbolic skill. In some of them it is definitely verbal whereas in others it is just symbolic in general. Factor 4 has two very definite loadings, these are for Subtests 11 (Coding) and 12 (Mazes). This factor has been interpreted as a Perceptual-Motor-Spatial ability. Some additional support for this comes from a moderate loading by Object Assembly (10) on this factor.

To continue with the replication, a Kaiser factor match was performed with the WISC factor loading matrices. The Group 2 Equamax rotation was further rotated using the Group 1 Varimax as the target. This new Group 2 rotation (Table 18) which had the maximum amount of overlap with the Group 1 Varimax rotation was interpreted and used for subsequent analyses. The cosines for the angles between the Group 1 Varimax factors and Group 2 Kaiser rotated factors are shown in Table 19. They indicate that Group 1 Factors 1, 2, 3, and 4 most resemble Group 2 Factors 4, 2, 1, and 3 respectively. Bearing in mind the cosine values and comparing the appropriate factors we notice that Subtests 4, 5, 9, and 10 (Similarities; Vocabulary; Block Design; Object Assembly) are common, in terms of loadings over 0.300, to both Factor 1 in Group 1 and Factor 4 in Group 2. Factor 4 in Group 2 would likewise be interpreted as a Reasoning factor. Subtests 1, 2, 3, 4, 6, and 9 (Information; Comprehension; Arithmetic; Similarities; Digit Span; Block Design) are common to the Group 1 Factor 2 and Group 2

TABLE 19

KAISER ROTATED WISC COSINE VALUES BETWEEN THE GROUP 1
VARIMAX ORTHOGONALLY ROTATED SOLUTION AS THE TARGET
AND THE GROUP 2 EQUAMAX ORTHOGONALLY ROTATED SOLUTION

Group 2 Reference Axes (N=50)	Group 1 Reference Axes (N=50)			
	1	2	3	4
1	-005	386	915	-115
2	345	858	-371	-087
3	205	059	099	972
4	916	-334	123	-185

Decimal points omitted.

Group 1 Factor Designations:

- 1 -- Reasoning
- 2 -- General Memory (long and short term)
- 3 -- Verbal-Symbolic
- 4 -- Perceptual-Motor-Spatial

Group 2 Factor Designations:

- 1 -- Verbal-Symbolic
- 2 -- General Memory (long and short term)
- 3 -- Perceptual-Motor-Spatial
- 4 -- Reasoning

Factor 2. In fact a high loading by the Picture Completion subtest (7), which is considered in other factor analysis studies to contribute to memory, adds further support to classifying the Group 2 Factor 2 as Memory. According to the factor match, Group 2 Factor 1 is interpreted as a Verbal-Symbolic ability. Subtests 1, 2, 5, and 11 (Coding) are common to this factor and to the third factor in Group 1. The Perceptual-Motor-Spatial Factor 4 in Group 1 and the Group 2 Factor 3 have Subtests 11 and 12 (Mazes) loading commonly. The Group 2 factor also seems to have some adequate loadings on the Block Design (9) and Object Assembly (10) subtests. Performance on these subtests too requires a spatial and perceptual-motor ability, thus further confirming the naming of this factor as a Perceptual-Motor-Spatial ability. A cursory examination of the factor loadings for the total Group 12 Varimax rotation in Table 20, indicates a number of inconsistencies relative to Group 1 and Group 2. We find that out of the sixteen loadings that are common between Groups 1 and 2 for the respective factors five of these are not common with the corresponding factors for Group 12.

Although the mathematical match between Groups 1 and 2 appeared above the accepted 30 degrees (Hunka, 1969, personal communication) for three of the pairs, the matching in terms of subtest factor loadings to interpret the factors with respect to underlying skills and abilities is

TABLE 20

WISC SUBTEST ORTHOGONAL VARIMAX ROTATION FACTOR
LOADING MATRIX FOR GROUP 12
(N=100)

WISC Sub- tests	Factors				h^2
	1	2	3	4	
1	678	475	154	-006	709
2	446	560	120	238	584
3	700	235	012	-273	620
4	819	071	038	311	773
5	608	364	030	429	688
6	122	729	028	-048	549
7	205	563	240	303	508
8	068	072	021	755	580
9	436	217	479	150	489
10	488	-259	573	280	713
11	031	190	597	433	581
12	-067	124	812	-214	724
Variance Totals	2.684	1.752	1.673	1.411	7.520
Per cent of Common	35.69	23.31	22.26	18.77	100.00
Per cent of Total	22.36	14.59	13.93	11.75	62.65

Decimal points omitted.

Designations:

- Factor 1 -- Reasoning
- Factor 2 -- General Memory (long and short term)
- Factor 3 -- Perceptual-Motor-Spatial
- Factor 4 -- Verbal-Symbolic

WISC Subtest designations as in Table 14, page 95.

somewhat less encouraging. However the above Group 1 versus Group 2 comparison does lend credibility to the idea that the WISC measures similar abilities in different independent groups.

THE HOME ENVIRONMENT-MENTAL ABILITY RELATIONSHIPS (DEPVAR-WISC)

The testing of Hypothesis 2 involved a comparison of the DEPVAR variable scores with WISC subtest and IQ scores. It also included analyses for establishing relationships between persons' scores based on the environment and ability factors as identified in the preceding sections. These person scores, referred to as factor scores (Horst, 1965, pp. 97, 468; Harris, 1967), are in actuality gradings that the person gets on these "composite tests" called factors. Using the original data matrices, these being the WISC subtest scores and the DEPVAR variable scores, with the corresponding factor loading matrices, factor scores were obtained for all the Ss for the four DEPVAR factors and the four WISC factors. The factor scores were not only used in "factor score-factor score" relationship but were also correlated with the three WISC IQ scores (Verbal, Performance, Full Scale).

As mentioned in the previous section data in the form of variable scores, subtest scores, IQ scores, and factor scores were generated for analyses. To test the hypothesized relationships for Hypothesis 2 the following comparisons were made: (1) DEPVAR variable scores with WISC subtest scores, (2) DEPVAR variable scores with WISC IQ scores, (3) DEPVAR factor scores with WISC factor scores, and (4) DEPVAR factor scores with WISC IQ scores.

DEPVAR Variable Score Analyses

DEPVAR variables - WISC subtests. Before going into the specific relationships between the DEPVAR variable scores and the WISC subtest scores a general multiple relationship was established. Using a Canonical correlation analysis (Morrison, 1967, p. 213) the best (in a least squares sense) linear combination of the ten DEPVAR variables was correlated with the best combination of the WISC subtests. All twenty-two variables were considered simultaneously and a multiple predictor-multiple criterion type of product-moment correlation coefficient, called a Canonical correlation, was calculated. The coefficients for Groups 1, 2, and 12 were 0.752, 0.838, and 0.705 respectively. These values indicate that there are substantial relationships between the two sets of variables. We must note however, that for Groups 1 and 2 fairly high

correlation coefficients were expected since there were only fifty subjects in each group.

Part (a) of this hypothesis stated that DEPVAR Variables 1, 2, 3, and 4 (Aspirations and Expectations; Knowledge of Child's Development; Opportunity for Language Development; Language Model) would relate particularly well to verbal or academic type of performance. Results of Group 1 indicate and those of Group 2 replicate that DEPVAR Variables 1 and 3 relate particularly well with the Verbal WISC Subtests 1, 2, 4, and 5 (Information; Comprehension; Similarities; Vocabulary). Tables 21 and 22 illustrate a few significant correlations, which are replicated in the two groups, between the two DEPVAR variables (1 and 3) and WISC Subtests 9, 10, 11, and 12 (Block Design; Object Assembly; Coding; Mazes). Although these latter relationships were not hypothesized, they strongly support Wolf's (1964a) results. DEPVAR Variable 2, although not highly related to most of the WISC subtests, does relate consistently over Groups 1 and 2 for WISC Subtests 1 and 5 to support the hypotheses. The Language Model variable (4) relationships for the two groups show considerable inconsistencies. The correlations for Group 1 are generally lower than they are for Group 2 and, although there is mild replication on WISC Subtests 1, 4, 5, and 12 the other subtest relationships are highly divergent for the two groups. Almost all the relationships between the Female Dominance variable and

TABLE 21

CORRELATION COEFFICIENTS BETWEEN WISC SUBTEST SCORES
AND DEPVAR VARIABLE SCORES FOR GROUP 1

WISC Sub- tests	DEPVAR Variables (N=50)									
	1	2	3	4	5	6	7	8	9	10
1	386	255	471	199	-061	357	-065	-078	361	210
2	473	023	397	083	-083	346	-028	-055	040	042
3	369	042	494	222	-106	257	-091	-080	109	-029
4	162	139	320	227	-096	285	-040	-218	276	292
5	423	302	421	170	-136	289	-199	-304	427	176
6	336	161	179	-207	-099	021	095	090	079	-028
7	234	094	172	-014	-008	148	-018	127	178	053
8	072	093	187	020	-149	058	-182	-173	221	-062
9	287	284	427	020	-140	119	-343	-303	326	193
10	271	255	378	198	-145	090	-326	-256	399	323
11	361	-006	304	042	-215	088	-077	-057	229	-015
12	275	056	103	210	056	005	-029	160	052	-076

Critical r for 0.05 level = ± 0.278 ; for 0.01 level = ± 0.360

Decimal points omitted.

WISC Subtest Designations:

- | | |
|-------------------|-------------------------|
| 1 - Information | 7 - Picture Completion |
| 2 - Comprehension | 8 - Picture Arrangement |
| 3 - Arithmetic | 9 - Block Design |
| 4 - Similarities | 10 - Object Assembly |
| 5 - Vocabulary | 11 - Coding |
| 6 - Digit Span | 12 - Mazes |

DEPVAR Variable Designations:

- 1 - Academic and Vocational Aspirations and Expectations of Parents
- 2 - Knowledge of, and Interest In, Child's Academic and Intellectual Development
- 3 - Material and Organizational Opportunities for the Use and Development of Language
- 4 - Quality of Language in the Home
- 5 - Female Dominance in Child Rearing
- 6 - Planfulness, Purposefulness, and Harmony in the Home
- 7 - Dependency Fostering - Overprotection
- 8 - Authoritarian Home
- 9 - Interaction with Physical Environment (Visual and Kinaesthetic Experiences)
- 10 - Opportunity for, and Emphasis on, Initiating and Carrying Through Tasks

TABLE 22

CORRELATION COEFFICIENTS BETWEEN WISC SUBTEST SCORES AND DEPVAR VARIABLE
SCORES FOR GROUP 2

WISC Subtests	1	2	3	4	5	6	7	8	9	10
	DEPVAR Variables (N=50)									
1	294	222	305	282	-225	149	-184	047	187	374
2	290	139	307	466	100	157	-176	-126	210	168
3	107	238	086	-003	-258	335	-300	-011	112	172
4	356	155	327	355	009	290	-262	-082	438	103
5	340	239	353	433	-004	162	-227	-077	309	205
6	249	125	119	043	-118	001	-017	-013	-322	021
7	-018	103	-090	143	062	-177	-092	000	112	066
8	216	056	175	317	-042	118	021	-177	131	-329
9	261	123	164	226	-082	103	-025	-024	022	141
10	213	028	373	146	-120	038	085	-155	-119	004
11	343	051	336	212	022	156	-110	-288	097	106
12	385	043	244	185	-259	114	079	-029	-098	100

Critical r for 0.05 level = +0.278; for 0.01 level = +0.360.

Decimal points omitted.

WISC Subtest Designations as in Table 14, page 95.
DEPVAR Variable Designations as in Table 8, page 82.

the WISC subtests are negative for both groups. That these relationships are especially negative for Arithmetic, Block Design, and Object Assembly is support for the hypothesis that this DEPVAR variable should relate low with numerical, reasoning, and spatial abilities. The Planfulness variable (6) relations are replicated moderately on WISC Subtests 1 and 2, and well on Subtests 3 (Arithmetic), 4, and 5. Although the relationships for this DEPVAR variable seem to be predominantly with academic and verbal types of abilities, the adequate correlations with Comprehension (2), Arithmetic (3), and Similarities (4) support, to a limited extent, the hypothesis that Planfulness would relate to performance which involves concerted attention, reasoning, and logical thinking.

Both the Overprotection (7) and the Authoritarian (8) variable intercorrelations are almost exclusively negative or zero with all the WISC subtests. Although replication of strong correlates between Group 1 and Group 2 is minimal some of the highest negative correlations are with subtests that require verbal and problem solving reasoning as well as spatial abilities, such as Arithmetic (3), Block Design (9), Object Assembly (10), and Vocabulary (5). With the exception of the Object Assembly (10) and Picture Arrangement (8) subtests, the Authoritarian variable shows very little replication between Groups 1 and 2. However the replicated negative correlations for WISC Subtests 8

(Picture Arrangement), 9, and 10 do indicate that the Authoritarian variable relates poorly with reasoning, spatial, and social abilities. One can conclude for both DEPVAR Variables 7 and 8 (Dependency-Overprotection; Authoritarian) that scores on these characteristics in the home relate negatively to any mental ability as might be described by performance on the WISC.

For Group 1 DEPVAR Variable 9 (Environmental Interaction) the significant intercorrelations are with WISC Subtests 1, 4, 5, 9, and 10 (Information; Similarities; Vocabulary; Block Design; Object Assembly). Replication with Group 2 is on the basis of WISC Subtests 1, 4, and 5. Support for the hypothesized relationships of this DEPVAR variable with spatial and perceptual abilities, in the form of replication, is lacking. The relationships that do replicate suggest that this environmental characteristic relates to more academic and verbal types of reasoning abilities. DEPVAR Variable 10 (Completing Tasks) shows moderate replication on WISC Subtests 1, 4, 5, and 9 although Group 1 had a significant correlation for the Object Assembly subtest (10). These relationships give minimal support for the hypothesized relationship of DEPVAR Variable 10 with spatial abilities. Just as for DEPVAR Variable 9 (Environmental Interaction) the correlations suggest a relationship between this DEPVAR variable and academic, probably verbal reasoning, types of abilities.

The Group 12 results presented in Table 23 give us a better estimate of the population values. DEPVAR Variables 1, 3, and 9 (Aspirations and Expectations; Opportunity for Language Development; Environmental Interaction) provide significant relationships with most of the WISC subtests. These variables seem to be related to an overall intelligence represented by a variety of WISC subtests. The Language Model variable (4) relates predominantly to the verbal aspects of intellectual performance. DEPVAR Variables 5, 7, and 8 (Female Dominance; Dependency-Overprotection; Authoritarianism), as in the replication results, show zero or negative correlations with all aspects of the WISC. Again the most negative relationships are with reasoning, spatial, and perceptual abilities. The coefficients for the Planfulness variable illustrate a definite relationship with an academic, more verbal type of ability, rather than with non-verbal spatial abilities. The verbal academic WISC subtests do however represent reasoning skills as they may contribute to overall intelligence.

DEPVAR variables - WISC IQs. Examination of Table 24 shows that Group 1 DEPVAR Variables 1, 3, 6, and 9 (Aspirations and Expectations; Opportunity for Language Development; Planfulness; Environmental Interaction) show the highest correlations with Verbal, Performance, and Full IQ scores of all the environmental variables. The

TABLE 23

CORRELATION COEFFICIENTS BETWEEN WISC SUBTEST SCORES AND DEPVAR VARIABLE SCORES
FOR GROUP 12

WISC Subtests	1	2	3	4	5	6	7	8	9	10
	DEPVAR Variables (N=100)									
1	343	241	395	245	-134	243	-132	-020	275	300
2	369	082	348	312	003	253	-106	-086	130	113
3	238	136	314	099	-172	290	-199	-050	114	071
4	273	148	324	302	-044	279	-165	-151	369	190
5	378	265	381	331	-064	203	-220	-181	363	190
6	296	144	155	-071	-103	-008	029	019	-121	-005
7	103	100	051	073	025	-023	-060	054	148	059
8	155	076	183	187	-096	077	-079	-185	179	-206
9	272	213	314	129	-118	119	-187	-161	178	170
10	243	142	376	169	-131	058	-108	-206	125	154
11	346	022	313	147	-100	136	-089	-172	150	054
12	324	049	161	199	-080	071	030	-081	-028	117

Critical r for 0.05 level = +0.197; for 0.01 level = +0.257

Decimal points omitted.

WISC Subtest Designations as in Table 14, page 95.
DEPVAR Variable Designations as in Table 8, page 82.

TABLE 24

CORRELATION COEFFICIENTS BETWEEN DEPVAR VARIABLE SCORES AND WISC VERBAL, PERFORMANCE,
AND FULL IQ SCORES FOR GROUPS 1, 2, AND 12

WISC IQs	DEPVAR Variables (N=50)									
	1	2	Group 1 3	4	5	6	7	8	9	10
V	532	243	549	193	-142	391	-100	-156	347	202
P	421	262	452	138	-179	165	-317	-192	436	150
F	527	283	557	186	-172	314	-223	-198	429	198

WISC IQs	DEPVAR Variables (N=50)									
	1	2	Group 2 3	4	5	6	7	8	9	10
V	367	223	345	379	-084	232	-278	-072	253	210
P	349	087	326	329	-049	084	-061	-233	062	-006
F	432	201	413	425	-093	193	-209	-163	201	141

WISC IQs	DEPVAR Variables (N=100)									
	1	2	Group 12 3	4	5	6	7	8	9	10
V	445	234	446	304	-111	296	-202	-116	300	207
P	384	179	394	247	-121	131	-183	-208	243	072
F	482	246	493	321	-135	252	-218	-181	316	170

For N=50 critical r for 0.05 level = ± 0.278 ; for 0.01 level = ± 0.360 .

For N=100 critical r for 0.05 level = ± 0.197 ; for 0.01 level = ± 0.257 .

Decimal points omitted.

DEPVAR Variable Designations as in Table 8, page 82.

Group 2 results are consistent for Variables 1 and 3 but not quite so for Variables 6 and 9. To the degree that the results replicate we notice that the relationships for DEPVAR Variables 1, 3, and 6 are higher with the Verbal IQ, while for Group 1 Variable 9, the correlations are higher with the Performance IQ. As with the WISC subtests, the Language Model (4) does not replicate too well in terms of levels of relationships, although both groups show a positive relationship for all three IQs with the Performance coefficient being lower than the Verbal one. The Female Dominance variable (5) relates negatively for all IQs for both groups although the Group 2 coefficients can essentially be considered to be zero. As hypothesized the correlation between Female Dominance (5) and Performance IQ is more negative than between this variable and Verbal IQ in Group 1.

The Overprotection (7) and Authoritarian (8) variable results replicate well, showing negative correlations with all three IQs, and in three out of the four cases indicating higher negative relationships with Performance than with Verbal IQs. DEPVAR Variable 10 (Completing Tasks), whose correlations with all three IQs are low, are nevertheless somewhat consistent across the two groups. The trend in both groups which shows the relationships to be lowest with the Performance IQ is contrary to the hypothesized direction.

To get a clearer picture of the population values the Group 12 portion of Table 24 was examined. Five DEPVAR variables, namely 1, 2, 3, 4, and 9 (Aspirations and Expectations; Knowledge of Child's Development; Opportunity for Language Development; Language Model; Environmental Interaction) relate significantly to all three IQ scores. Variables 5, 7, and 8 (Female Dominance; Dependency-Overprotection; Authoritarianism) all have low negative correlations with the Verbal, Performance, and Full IQs. The Planfulness (6) and Initiating Tasks (10) variables, although relating significantly with Verbal IQ, seem to show near zero correlations with Performance IQ scores.

DEPVAR Factor Score Analyses

DEPVAR factor scores - WISC factor scores. As with the variable-subtest comparisons a general relationship between the two sets of factor scores was calculated. A Canonical correlation between the four DEPVAR factor scores and four WISC factor scores was obtained for all three groups. The coefficients for Groups 1, 2, and 12 are 0.592, 0.665, and 0.569 respectively with respective probabilities of such correlations being different from zero due to chance as less than 0.02, less than 0.001, and less than 0.001 according to Bartlett's test (Cooley and Lohnes, 1962, p. 37).

An overall examination of Table 25 reveals trends in the results which are similar to the variable-subtest relationships. Considering the clustering of variables or subtests into factors we notice that similar relationships as well as consistencies or inconsistencies in the replication are present.

DEPVAR Factor 1, although hypothesized to relate to verbal and academic types of skills, likewise correlates with the Reasoning and Perceptual-Motor-Spatial WISC factors. It appears that this DEPVAR factor might be related to an overall ability. With the exception of the Memory factor correlations, which are quite different for Group 1 and Group 2, the Aspiration factor-ability factor relationships are almost the same. The negative Authoritarian-Reasoning correlations are similar across the two groups and add support to this hypothesis. The relationships between DEPVAR Factor 2 and the WISC Factors 2 and 3 are nearly zero in all cases for both groups. Earlier results indicating a zero or negative correlation between Authoritarian environments and any abilities are confirmed here.

The relationships with the Environment factor (3) which was hypothesized to relate well with non-verbal reasoning and spatial-perceptual skills do not support the hypothesis. Although the relationship between the Reasoning and Environment factors is significant for Group 1 the

TABLE 25

CORRELATION COEFFICIENTS BETWEEN DEPVAR FACTOR SCORES
AND WISC FACTOR SCORES FOR GROUPS 1, 2, AND 12

N=50		Group 1 DEPVAR Factors			
		1	2	3	4
Group 1 WISC Factors	1	173	-344	344	090
	2	410	069	065	047
	3	147	077	060	107
	4	111	-026	082	-190

N=50		Group 2 DEPVAR Factors			
		1	2	3	4
Group 2 WISC Factors	1	284	-114	-146	154
	2	-035	-072	292	-072
	3	232	-030	061	510
	4	333	133	032	-041

N=100		Group 12 DEPVAR Factors			
		1	2	3	4
Group 12 WISC Factors	1	295	-204	281	161
	2	159	108	028	034
	3	069	-200	-061	201
	4	252	025	043	088

For N=50, critical r for 0.05 level = ± 0.278 ; for 0.01 level = ± 0.360 .

For N=100, critical r for 0.05 level = ± 0.197 ; for 0.01 level = ± 0.257 .

Decimal points omitted.

Designations:

WISC Factors:

1. Reasoning
2. General Memory
3. Verbal-Symbolic
4. Perceptual-Motor-Spatial

DEPVAR Factors:

1. Aspirations-Planfulness-Harmony
2. Authoritarian-Over-protective
3. Activity-Environmental Interaction
4. Female-Language

results for Group 2 do not replicate this finding and in fact are related in the opposite direction. As for the Perceptual-Motor-Spatial factor (4), with the exception of the 0.333 relationship with the DEPVAR Factor 1, the correlations with the environment are essentially zero in both groups.

The Female-Language factor (4), through some very slight replication, provides some supporting relationships with WISC Factors 3 and 4. The low correlations of the Female-Language factor (4) with the Reasoning factor (1) and the negative relationships with the Perceptual-Motor-Spatial factor (4) provide support for Hypothesis 2. The positive correlations with the WISC Verbal factor (3), although low for Group 1, likewise provides support in the hypothesized direction.

Many of the correlation coefficients in this portion of the study are low therefore the relationships are examined in terms of directions. Although these trends must be interpreted with caution, some validity may be placed on these low correlations when the resulting directions are consistent in the replication group.

DEPVAR factor scores - WISC IQ scores. The correlations between the Aspiration factor (1) and all three IQ scores are replicable (Table 26). However it is the results of Group 1, which indicate a higher correlation for Verbal IQ than for

TABLE 26

CORRELATION COEFFICIENTS BETWEEN DEPVAR FACTOR SCORES
AND WISC VERBAL, PERFORMANCE, AND FULL IQ SCORES FOR
GROUPS 1, 2, AND 12

N=50		Group 1 DEPVAR Factors			
		1	2	3	4
WISC	1	492	-065	283	050
IQ	2	274	-256	321	-032
Scores	3	429	-175	333	016

N=50		Group 2 DEPVAR Factors			
		1	2	3	4
WISC	1	290	-092	183	347
IQ	2	400	-124	-065	164
Scores	3	407	-063	096	318

N=100		Group 12 DEPVAR Factors			
		1	2	3	4
WISC	1	391	-136	227	227
IQ	2	316	-185	088	188
Scores	3	415	-179	192	241

For N=50, critical r for 0.05 level = ± 0.278 ; for 0.01 level = ± 0.360 .

For N=100, critical r for 0.05 level = ± 0.197 ; for 0.01 level = ± 0.257 .

Decimal points omitted.

Designations:

WISC IQs:

1. Verbal
2. Performance
3. Full

DEPVAR Factors:

1. Aspirations-Planfulness-Harmony
2. Authoritarian-Overprotective
3. Activity-Environmental Interaction
4. Female-Language

Performance, that support Hypothesis 2. Again as in the previous analyses the Authoritarian factor (2) relates negatively with WISC Verbal, Performance, and Full IQs. Although all three correlations replicate, the one of most consequence is the Performance relationship. This is particularly so since the correlations for Performance are more negative than for the Verbal or Total IQs in both groups. As indicated in Table 26, the only replicable relationship for DEPVAR Factor 3 is the one with the Verbal IQ. This suggests that the Environmental Interaction factor (3) - Verbal IQ relationship is consistent over the two groups whereas the relationships for the Performance and Full IQs are not. It is interesting to note that for the DEPVAR Factor 3 in Group 1, all three relationships are significant and that the one for the Performance IQ is somewhat higher than the one for the Verbal IQ. Had there been replication for these results this would have provided additional credible support for Hypothesis 2. The Female-Language factor (4) shows essentially no relationship with any of the IQ scores for Group 1. Conversely this environmental factor shows high positive relationship particularly with Verbal and Full IQ for Group 2. As a result there is no consistency in relationships across the two groups.

MEAN DEPVAR SCORES AND SOCIO-ECONOMIC STATUS

One of the criteria for the construction of the DEPVAR scale was that the instrument be designed to measure dynamic press types of aspects or characteristics of the environment rather than the static, material possessions type usually considered in establishing socio-economic status ratings. The scale was designed to get at what parents do in the home rather than what they are. Bearing in mind the criteria for constructing the scale, a hypothesis was nonetheless made stating that the mean scores on the ten DEPVAR variables would differ for the High and Low socio-economic groups. This was Hypothesis 3.

The use of individual t tests for the ten pairs of means would not have taken into account the dependencies among the ten variables. It was therefore decided to use the Hotelling T^2 analysis which does take into consideration the interdependencies which could produce spuriously significant results (Morrison, 1967, p. 133). Table 27 illustrates the mean scores and the pooled standard deviations for the High SES and Low SES subjects for Groups 1, 2, and 12. For the analysis of all three groups there were two samples, the High SES and the Low SES, and the number of variables, p , was 10. For Groups 1 and 2, N_1 , the number of subjects in the High SES sample and N_2 the number of subjects in the Low SES sample were both 25

TABLE 27

DEPVAR VARIABLE SCORE MEANS AND POOLED STANDARD DEVIATIONS FOR THE HIGH AND LOW SOCIO-ECONOMIC STATUS SAMPLES

DEPVAR Vari- ables	Group 1			Group 2			Group 12		
	High SES N ₁ =25 \bar{X}_1	Low SES N ₂ =25 \bar{X}_2	Pooled S.D.	High SES N ₁ =25 \bar{X}_1	Low SES N ₂ =25 \bar{X}_2	Pooled S.D.	High SES N ₁ =50 \bar{X}_1	Low SES N ₂ =50 \bar{X}_2	Pooled S.D.
1	4.90	4.15	0.60	4.88	4.02	0.63	4.89	4.09	0.61
2	5.00	4.63	0.82	4.95	4.64	0.75	4.97	4.63	0.78
3	4.40	3.72	0.67	4.28	3.75	0.57	4.34	3.74	0.62
4	4.32	3.74	1.19	4.80	3.45	1.32	4.60	3.59	1.26
5	3.94	4.19	0.89	3.97	4.08	0.71	3.96	4.13	0.80
6	4.28	4.09	0.57	4.46	4.22	0.55	4.37	4.16	0.56
7	3.80	4.02	0.46	4.02	4.02	0.49	3.86	4.02	0.47
8	3.82	4.26	0.54	3.97	4.41	0.56	3.90	4.33	0.55
9	4.40	4.04	0.58	4.39	3.89	0.58	4.39	3.96	0.58
10	4.19	3.95	0.79	4.15	4.06	0.82	4.17	4.00	0.80

DEPVAR Variable designations as in Table 8, page 82.

whereas for Group 12 both N s were 50. To calculate the T^2 statistic and ultimately the observed F value the following data were also required:

$\bar{X}'_1 = [\bar{x}_{11}, \bar{x}_{12}, \dots, \bar{x}_{1p}]$ -- the vector of means for the High SES sample

$\bar{X}'_2 = [\bar{x}_{21}, \bar{x}_{22}, \dots, \bar{x}_{2p}]$ -- the vector of means for the Low SES sample

A_1 -- matrix of deviation sums of squares and products for the High SES sample.

A_2 -- matrix of deviation sums of squares and products for the Low SES sample.

$S = \frac{1}{N_1 + N_2 - 2} (A_1 + A_2)$ -- pooled covariance matrix.

The Hotelling T^2 was then calculated from:

$$T^2 = \frac{N_1 N_2}{N_1 + N_2} \cdot (\bar{X}_1 - \bar{X}_2)' S^{-1} (\bar{X}_1 - \bar{X}_2)$$

and the F value by:

$$F = \frac{T^2 (N_1 + N_2 - p - 1)}{[(N_1 + N_2 - 2) p]}$$

The Division of Educational Research Fortran program MULV08 was used to get, the T^2 statistics, the observed F values, and the probabilities of such differences occurring by chance under the hypothesis of no differences between group centroids. These statistics, plus the critical F

values for the 0.05 confidence level are presented in Table 28. The observed F values are the result of the most appropriately weighted linear combinations of the ten variables. We notice that with these optimal weights, the combination of all ten variables gives us highly significant results for Groups 1, 2, and 12.

TABLE 28

SUMMARY OF THE HOTELLING T^2 ANALYSIS OF DEPVAR VARIABLE SCORE DIFFERENCES BETWEEN THE HIGH AND LOW SOCIO-ECONOMIC STATUS SAMPLES FOR GROUPS 1, 2, AND 12

	T^2	Obs. F-ratio	Crit. $F_{.05;10,39}$	Crit. $F_{.05;10,89}$	Prob.
Grp. 1 ($N_1=25$, $N_2=25$)	41.41	3.36	2.11		0.003
Grp. 2 ($N_1=25$, $N_2=25$)	54.49	4.43	2.11		0.001
Grp. 12 ($N_1=50$, $N_2=50$)	77.32	7.02		1.95	0.001

A posteriori analyses were carried out to see which of the ten mean differences may have contributed to the significant overall Fs. Again due to the dependency among the variables and the chance possibility of finding a significant single pair, simultaneous confidence intervals were set up to test the individual pairs. These intervals are actually ellipsoidal confidence regions for the

difference $\mathcal{S} = u_1 - u_2$ of the population mean vectors. For our test \mathcal{S} was assumed to be zero. The confidence regions are expressed in terms of:

$$a' (\bar{X}_1 - \bar{X}_2) - \sqrt{a' S a \frac{(N_1 + N_2)}{(N_1 N_2)} T^2} \leq a' \mathcal{S} \leq$$

$$a' (\bar{X}_1 - \bar{X}_2) + \sqrt{a' S a \frac{(N_1 + N_2)}{(N_1 N_2)} T^2}$$

where a' is a weight vector. In this case where we are testing individual pairs the element corresponding to the pair being tested is unity whereas all the other elements in the vector are zeros. In this analysis the Scheffe test was used to check the differences between the pairs of score means. Since the Scheffé procedure is one of the most rigorous ones and since we are testing the differences in mean scores for ten virtually independent variables a decision was made to set 0.10 confidence limits for examining the individual pairs. The calculated 90 per cent confidence limits and the probabilities for such individual pair mean differences occurring by chance for Groups 1, 2, and 12 are summarized in Table 29. With the exception of the cases for Variables 1 (Aspirations and Expectations) in Group 2 and

TABLE 29

SIMULTANEOUS 90 PER CENT CONFIDENCE REGIONS AND
PROBABILITIES OF SUCH DIFFERENCES OCCURRING BY
CHANCE FOR THE HOTELLING T^2 INDIVIDUAL
COMPARISONS BETWEEN THE HIGH AND LOW
SOCIO-ECONOMIC STATUS SAMPLE MEANS
FOR EACH DEPVAR VARIABLE

DEPVAR Vari- ables	Grp. 1 $N_1=25, N_2=25$	Grp. 2 $N_1=25, N_2=25$	Grp. 12 $N_1=50, N_2=50$
1	$-0.042 \leq \delta \leq 1.546$ $p=0.1475$	$0.025 \leq \delta \leq 1.687$ $p=0.0793$	$0.219 \leq \delta \leq 1.329$ $p=0.0002^*$
2	$-0.715 \quad 1.451$ $p=0.9947$	$-0.680 \quad 1.296$ $p=0.9974$	$-0.330 \quad 1.006$ $p=0.9292$
3	$-0.199 \quad 1.559$ $p=0.4166$	$-0.223 \quad 1.279$ $p=0.5640$	$0.076 \quad 1.132$ $p=0.0254^*$
4	$-0.993 \quad 2.153$ $p=0.9899$	$-0.391 \quad 3.095$ $p=0.4124$	$-0.117 \quad 2.049$ $p=0.2267$
5	$-1.425 \quad 0.921$ $p=0.9999$	$-1.045 \quad 0.837$ $p=1.0000$	$-0.864 \quad 0.508$ $p=0.9996$
6	$-0.564 \quad 0.956$ $p=0.9995$	$-0.492 \quad 0.964$ $p=0.9964$	$-0.268 \quad 0.700$ $p=0.9700$
7	$-0.832 \quad 0.384$ $p=0.9900$	$-0.746 \quad 0.554$ $p=1.0000$	$-0.567 \quad 0.247$ $p=0.9883$
8	$-1.138 \quad 0.274$ $p=0.7518$	$-1.177 \quad 0.297$ $p=0.7787$	$-0.905 \quad 0.033$ $p=0.1739$
9	$-0.409 \quad 1.129$ $p=0.9446$	$-0.259 \quad 1.259$ $p=0.6591$	$-0.064 \quad 0.924$ $p=0.2611$
10	$-0.806 \quad 1.278$ $p=0.9998$	$-0.982 \quad 1.174$ $p=1.0000$	$-0.518 \quad 0.850$ $p=0.9998$

DEPVAR Variable designations as in Table 8, page 82.

Variables 1 and 3 (Opportunity for Language Development) in Group 12, the hypothesized zero value is included in the intervals. Although DEPVAR Variable 1 does not quite reach the 0.10 level for Group 1, it appears to be the only single variable whose scores are significantly different for the High and the Low socio-economic groups. The trends for DEPVAR Variable 3 in Groups 1 and 2 support the significant difference in Group 12. Results for DEPVAR Variable 4 (Language Model) show fairly low probabilities of such differences occurring by chance for Groups 2 and 12 but lack any support for such a direction in Group 1. Other variables which could suggest that differences in scores may occur between the two socio-economic groups are Variable 8 (Authoritarianism) and Variable 9 (Environmental Interaction) in the combined Group 12. Generally we could say that most of the pairs of scores, when compared individually, do not show significant differences at the 0.10 level. Assignment of varied weights (other than unity) to a number of pairs simultaneously for a single comparison would probably bring out clusters of 2 or 3 variables, with appropriate weights, which would indicate significant mean differences. The theoretical limitations of this study however prohibit such further analyses.

The greatest support for Hypothesis 3 comes from the significant difference in means when all ten DEPVAR variables for Group 1 are compared collectively. Results from Group 2,

the replication sample, likewise confirm the hypothesis. Examination of the individual comparisons in both Group 1 and Group 2 shows that the only evidence which may be considered with any confidence in terms of variables contributing singly to the difference between the High SES and Low SES samples, would be the results for Variable 1. Variable 3 values, although showing significance for Group 12, appear only as fairly low probability trends in Groups 1 and 2. The results of the combined Group 12 confirm the trend in Group 1 and Group 2 in indicating that the Variable 1 and 3 pairs are significantly different at the 0.0002 and 0.0254 levels respectively.

The results for Group 12 also indicate that the mean differences for Variables 4, 8, and 9 (Language Model; Authoritarianism; Environmental Interaction) are approaching low chance probabilities. The trend for these three variables although there, is much less prominent for the variables in Group 1 and Group 2.

DEPVAR VARIABLE AND FACTOR SCORES - WISC FULL
SCALE IQ RELATIONSHIPS AND SOCIO-ECONOMIC
STATUS

Hypothesis 4 stated that scores for corresponding DEPVAR variables or DEPVAR factors (factor scores) do not relate similarly to total IQ for the High SES sample and the Low SES sample. Groups 1, 2, and 12 were divided, on the basis of the socio-economic scores (SES), into the High SES and Low SES. The grouping here is identical to that used for the analysis of the Hotelling T^2 statistic. The first analysis involved a product-moment correlation for all three groups for both socio-economic levels between the ten DEPVAR variable scores and the WISC Full IQ.

Examination of Table 30 reveals that in Group 1 the correlations for the Low SES are generally lower than for the High SES. Variables 1, 3, and 9 (Aspirations and Expectations; Opportunity for Language Development; Environmental Interaction) in addition to being the highest for both SES samples, also display the same order when ranked according to magnitude. The replication group results do not confirm the findings for Group 1. In fact the coefficients in Group 2 for the three mentioned variables seem to be lower for the High SES and even negative for Variable 9. The Language Model variable (4) relates more to IQ for Low SES than for the High in Group 1 whereas

TABLE 30

CORRELATION COEFFICIENTS BETWEEN DEPVAR VARIABLE SCORES
AND WISC FULL IQ SCORES FOR THE HIGH AND LOW SOCIO-
ECONOMIC STATUS SAMPLES

DEPVAR Vari- ables	Grp. 1		Grp. 2		Grp. 12	
	High	Low	High	Low	High	Low
	SES N=25	SES N=25	SES N=25	SES N=25	SES N=50	SES N=50
1	569	279	222	405	392	348
2	396	113	018	240	199	175
3	649	305	161	410	442	366
4	021	163	404	274	231	218
5	-402	039	069	-197	-164	-060
6	289	256	-169	403	022	326
7	-263	-042	-362	-057	-325	-051
8	-303	092	-175	042	-242	069
9	427	294	-053	202	180	248
10	235	092	123	131	181	115

For N=25, critical r for 0.05 level = ± 0.396 ; for 0.01 level = ± 0.505 .

For N=50, critical r for 0.05 level = ± 0.278 ; for 0.01 level = ± 0.360 .

Decimal points omitted.

DEPVAR Variable designations as in Table 8, page 82.

the opposite is true in Group 2. A large difference occurs within Group 1 for the Female Dominance (5) variable. However, again, an opposite effect occurs in Group 2. Variable 10 (Completing Tasks) shows a much higher relationship with IQ for the High SES sample in Group 1 whereas in Group 2 the relationships for both SES samples are about the same.

The two variables that have different relationships within a group and have similarly different coefficients in the replication group are Overprotection (7) and Authoritarianism (8). For both, Groups 1 and 2, the High SES samples show a fairly high negative relationship with IQ while the Low SES samples have virtually zero correlations.

Although a number of the variables would support the hypothesis being tested, the lack of consistency in the replication group suggests that the differences could be due to chance. The only DEPVAR variables that could be considered with any certainty or replicative confidence as supporting Hypothesis 4 are 7 and 8 (Dependency-Overprotection; Authoritarianism).

In addition to comparing the DEPVAR variable scores, factor scores for the DEPVAR factors were correlated with the WISC Full IQ. The results with the factor scores seem to parallel those of the DEPVAR variable scores. Factors 1, 3, and 4 show opposite relationships in Group 1 to those in Group 2. As illustrated in Table 31 the only

TABLE 31

CORRELATION COEFFICIENTS BETWEEN DEPVAR FACTOR SCORES
AND WISC FULL IQ SCORES FOR THE HIGH AND THE LOW
SOCIO-ECONOMIC STATUS SAMPLES

DEPVAR Factors	Grp. 1		Grp. 2		Grp. 12	
	High SES N=25	Low SES N=25	High SES N=25	Low SES N=25	High SES N=50	Low SES N=50
1	454	256	195	354	264	339
2	-277	067	-089	-002	-287	021
3	371	204	-065	279	161	187
4	-226	146	268	178	128	162

For N=25, Crit. r for 0.05 level = ± 0.396 ; for 0.01 level = ± 0.505

For N=50, Crit. r for 0.05 level = ± 0.278 ; for 0.01 level = ± 0.360

Decimal points omitted.

Designations:

- Factor 1 -- Aspiration-Planfulness-Harmony
- Factor 2 -- Authoritarian-Overprotective
- Factor 3 -- Activity-Environmental Interaction
- Factor 4 -- Female-Language

difference between High SES and Low SES correlation coefficients that may be taken with confidence as support for this hypothesis is the one for Factor 2. There is a similar trend for this factor in Group 2. Group 12 on the other hand merely gives us a better estimate of what the population values might be for Factor 2.

CHAPTER VI

DISCUSSION, CONCLUSIONS, IMPLICATIONS

DISCUSSION

As mentioned in earlier chapters the objectives of this study were to identify and measure the home environment characteristics and see how they relate to mental ability. The home environments were identified in terms of ten different variables which were then correlated with different mental abilities such as verbal, spatial, perceptual-motor, numerical, reading, and memory, as well as with overall intelligence. The environmental characteristics were identified and examined individually, in terms of the ten DEPVAR variables, and in clusters or groupings when treated as factors. The ability measures were likewise treated as individual WISC subtests, as ability factors and as Verbal, Performance, and Full IQ scores.

That the study was performed with boys only reduces generalizability of the findings to that extent. However, as pointed out in the research reviewed in Chapter II, significant differences in the results for boys and for girls have been found in studies of environments. In considering both boys and girls, not only would a larger sample have been required to treat the two sexes separately to obtain the same rigor as was attained in this study, but

a different theoretical formulation would have been required with respect to the interview questions and the environmental variables for the girls than for the boys. In addition, different arrangements may have had to be made with regard to who should be interviewed to obtain the most complete and valid information about the home environment. At the expense of reduced generalizability, the physical and theoretical limitations of this study favored the use of a sample of boys from urban homes where the English language was at least one of the languages spoken.

To be able to place more confidence in the findings of this study, a full replication was done for all the analyses. Both groups were considered to be similar or coming from the same population. Basic statistics such as means and standard deviations of the variable scores showed that the two groups were comparable, however many of the correlational findings were quite different for the two groups. A few of the reasons for differences in results could be some unreliability in the instruments used or, actual differences within the groups as a result of sampling.

Nevertheless, when similar results were obtained for both groups the probability of such values occurring due to chance are deemed to be considerably smaller. Throughout the analyses, although results were discussed for the individual groups, the most confidence was placed in results that replicated. In factor analyzing both the

DEPVAR and the WISC, replicable structures contributed most heavily to the interpretation of the factors. After correlating these replicable environment and mental ability factor scores the relationships were likewise examined for consistency in the two 50-subject groups. Results of the analyses for the total sample of one hundred subjects were examined but mainly in terms of an indication of what might be a better estimate of population values.

The Results

Hypothesis 1. Hypothesis 1 stated that the DEPVAR would measure the home environment differentially. Examining this hypothesis in terms of the DEPVAR subtests we notice that, although the means are all in the vicinity of 4.00, there is adequate variation in scores within each variable. The low variable intercorrelations, particularly when the variance is appropriate for the size of N (Guilford, 1965), suggest that the different DEPVAR variables measure different aspects. With the reasonable replication of these coefficients as discussed in Chapter V we could conclude that the DEPVAR measures these different aspects reliably. Wolf's (1964) and Dyer's (1967) studies showed that their first factors in the unrotated solutions of the factor analysis of the environmental variables accounted for 79.61 per cent, and 75 per cent of the total variance. Table 32 for this study shows that the first factor accounted for

TABLE 32

PERCENTAGE OF TOTAL AND COMMON VARIANCE ACCOUNTED FOR
BY THE UNROTATED DEPVAR FACTORS FOR GROUPS 1, 2,
AND 12

		DEPVAR Factors			
		1	2	3	4
Grp. 1 N=50	Total	34.83	13.62	12.38	10.79
	Common	48.65	19.04	17.27	15.07
Grp. 2 N=50	Total	30.26	17.09	11.88	10.61
	Common	43.35	24.47	17.00	15.18
Grp. 12 N=100	Total	32.27	14.10	10.98	10.82
	Common	47.35	20.67	16.08	15.87

48.65 per cent and 43.35 per cent of the common variance and 34.83 per cent and 30.26 of the total variance for Groups 1 and 2 respectively. In fact the subsequent three factors accounted for more than 10 per cent each in both groups. This supports the idea that the DEPVAR measures the home environment "more differentially" than the previous instruments did. That the DEPVAR factors can be interpreted easily and similarly in both groups suggests that these different environmental aspects are meaningful and are measured consistently.

In addition to comparisons with existing forms of environmental measures, the validity of the DEPVAR, that is whether it really identifies and measures characteristics such as Female Dominance, Overprotection, or Planfulness, can be ascertained in terms of some of the relationships

between environmental characteristics and ability measures obtained in earlier studies. The degree to which the Hypothesis 2 relationships have been confirmed, as well as how the variables clustered in the factor analysis, gave us an estimate of the validity of the DEPVAR Scale. On the basis of the relationships, Variables 1, 2, and 3 (Aspirations and Expectations; Knowledge of Child's Development; Opportunity for Language Development) turned out generally as postulated. Variable 6 (Planfulness) did not relate as hypothesized. It related in the same direction that Variables 1, 2, and 3 did and according to the factor analysis appeared to be measuring environmental characteristics similar to Variables 1, 2, and 3. Variable 4 (Language Model) seems to be uncertain. Although it seems to relate as hypothesized for Group 2, it lacks replication in Group 1. Variables 5, 7, and 8 (Female Dominance; Dependency-Overprotection; Authoritarianism), because they related as hypothesized, would be considered valid measures. Variables 9 and 10 (Environmental Interaction; Completing Tasks), although relating to most abilities, especially in Group 1, did not quite relate as hypothesized. The relationships were similar to those of Variables 1, 2, and 3, yet the factor analysis showed these two variables to be quite different from Variables 1, 2, and 3.

Hypothesis 2. In discussing the results for Hypothesis

2 in terms of the ten DEPVAR variables all seven parts of this hypothesis can be evaluated individually. Part (a) states that DEPVAR Variables 1 to 4 should relate more to academic and verbal types of abilities. There was support for the verbal and academic relationship but there were also good correlations with reasoning as well as overall abilities. Studies by Freeberg (1967), Douglas (1964), and Rosen (1954) indicated that such environmental characteristics as those mentioned in Part (a) also relate highly to overall IQ and academic performance. Bernstein's (1961) theory of formal or complex language in the home relating to higher verbal ability was upheld when these DEPVAR variables showed relationships with Verbal IQ. However, there seemed to be large inconsistencies between Group 1 and Group 2 in the relationship with the WISC subtests and environmental Variable 4 (Language Model).

The DEPVAR Variable 5 (Female Dominance) relationship is hypothesized in Part (b) which states that this variable should relate less with spatial, numerical, and reasoning types of abilities than with verbal abilities. The results of this study show that essentially all the abilities correlate negatively with DEPVAR Variable 5, with the highest negative correlations appearing for the spatial, perceptual, and reasoning abilities. The replication with the IQ relationships was not as good as for the WISC subtests however the correlations were negative

for all three IQs in Group 1 and low negative or zero for Group 2. With Group 1 the highest negative value was for the Performance IQ, which in addition to the other relationships for Part (b), support Vernon's (1964a) and Bing's (1963) findings with respect to the female dominance characteristic of the home environment.

Part (c) in Hypothesis 2 which stated that planfulness, purposefulness and harmony in the home will relate highly to numerical and reasoning types of abilities was not upheld as clearly. The higher relationships for these environmental characteristics were with the Verbal WISC IQ rather than with the Performance. The best relationships were with subtests representing academic and verbal types of abilities. Vernon (1965a) and Schaefer and Bayley (1963) suggested that this type of an environmental variable (6) relates well to rational thinking and to an ability similar to Spearman's *g*. Only to the extent that such abilities are required in the performance of the WISC verbal subtests does this study support Vernon's and Schaefer and Bayley's findings.

Parts (d) and (e) both hypothesized similar outcomes. These were that Dependency Fostering-Overprotective (7) and Authoritarian (8) home environments will relate higher to verbal abilities than to numerical, spatial and reasoning abilities. Virtually all the relationships between DEPVAR Variables 7 and 8 and mental ability scores were negative, suggesting as did the results for Part (b), that

such environmental characteristics may not coincide with the development of any form of mental ability. Research by Witkin (1963), Haggard (1957), Bing (1963), and Dyk (1967) showed that children from these types of environments score lower on reasoning tasks or ones which require extensive self-discipline, as well as on tasks involving spatial and perceptual abilities. Confirmation for this hypothesis and for findings from earlier studies comes from those results in this study which indicate that the highest negative correlation coefficients were for spatial, numerical, and reasoning (both verbal or non-verbal) types of abilities.

Part (f) of Hypothesis 2 points out that interaction with the physical environment should relate highly to spatial, perceptual, and reasoning abilities. Support for probably the more crucial aspect of this hypothesis comes from the results of Group 1 only, with no replication of results from Group 2. These are the high relationships between DEPVAR Variable 9 (Environmental Interaction) and those subtests which require spatial, perceptual, and non-verbal reasoning skills. Group 1 also has the highest correlation with the Performance IQ scores. These findings concur with those of Bing (1963), Dyk (1967), Jensen (1967), Vernon (1965c), and Ferguson (1966). Since in Group 1 this DEPVAR variable also correlates fairly well with the verbal WISC subtests there is replication on numerous verbal subtests

with Group 2. If we were to place confidence in these replicated results it would seem that this particular environmental characteristic relates to an academic or verbal type of ability. In summary it appears that for Group 1 the relationships are strong for both verbal abilities as well as spatial, non-verbal reasoning and consequently for overall intelligence. For Group 2 on the other hand the strong relationships are with verbal types of abilities. Thus replication exists only for the verbal, and academic types of abilities.

Part (g) of the hypothesis states that DEPVAR Variable 10 (Completing Tasks) should likewise relate better with numerical or reasoning abilities than with verbal ones. Again as for Part (f), only Group 1 has higher relationships with some subtests which involve reasoning abilities. Vernon's (1965c) and Bing's (1963) results are not supported, nor is the hypothesis confirmed, by the results for both groups which indicate replicable relationships for Verbal rather than for Performance IQs. The only minimal support for this hypothesis comes from the Group 1 relationship mentioned above.

In order to discuss the results for Hypothesis 2 in terms of the DEPVAR and WISC factors we must decide which variables or characteristics these factors represent. According to the factor loadings given in Tables 10, 11 and 13 we would assume that the DEPVAR Factors in Table 25

relate to Hypothesis 2 as indicated in Table 33. By clustering a number of specific variables into one general type of environmental characteristic designated as Factor 1 we notice that we get a positive relationship with all ability factors except with memory in Group 2. This factor probably represents the strongest environmental correlate of overall ability. This is especially illustrated in Table 26. The relationships between DEPVAR Factor 1 scores and the ability factor and IQ scores probably concur most with findings by Douglas (1964), Freeberg (1967), and Bloom (1964), who state that these types of environmental characteristics are most highly related to overall intellectual development.

The Authoritarian-Overprotective factor, and its corresponding variables, correlate either negatively or not at all with the ability factors or the IQ scores. Although some studies suggested that this type of an environment would relate higher to verbal abilities they all indicated that relationships with abilities requiring spatial, numerical, rational thinking, and non-verbal reasoning skills would be low. The results of this study confirm the previous findings as well as the hypothesis in that the most negative correlations are with the Reasoning ability factor and the Performance IQ.

By considering the results of Group 1 only, the

TABLE 33

CONVERSION TABLE: DEPVAR FACTORS TO DEPVAR VARIABLES AND
CORRESPONDING HYPOTHESIS 2 SECTIONS

Factor	Hypothesis 2 Parts
1. Aspiration-Planfulness-Harmony	2a, 2c, negative 2b (DEPVAR Variables 1, 2, 3, 4, -5, 6)
2. Authoritarian-Over-protective	2d, 2e, negative 2f (DEPVAR Variables 7, 8, -9)
3. Activity-Environmental Interaction	2f, 2g, ii section of 2a (DEPVAR Variables 9, 10, 2)
4. Female-Language	2b, iv section of 2a (DEPVAR Variables 5, 4)

Consequently the relationships with ability should be approximately:

Factor 1 -- high verbal, academic, numerical, reasoning.

Factor 2 -- high verbal
-- low spatial, reasoning, numerical.

Factor 3 -- high spatial, perceptual, reasoning, academic, overall.

Factor 4 -- high verbal,
-- low spatial, reasoning.

DEPVAR Variable Designations:

1. Academic and Vocational Aspirations and Expectations of Parents.
2. Knowledge of, and Interest In, Child's Academic and Intellectual Development.
3. Material and Organizational Opportunities for the Use and Development of Language.
4. Quality of Language in the Home.
5. Female Dominance in Child Rearing.
6. Planfulness, Purposefulness, and Harmony in the Home.
7. Dependency Fostering - Overprotection.
8. Authoritarian Home.
9. Interaction with Physical Environment (Visual and Kinaesthetic Experiences).
10. Opportunity for, and Emphasis on, Initiating and Carrying Through Tasks.

hypothesized relationships of Factor 3 characteristics with mental abilities were, to a large extent, upheld. Vernon (1964a), Bing (1963), Ferguson (1966), and Witkin (1962) all found that environmental interaction, the opportunity to explore and do new things, relate to abstract reasoning abilities and facilitate the development of spatial and perceptual skills. Although support came from Group 1 for the reasoning relationship neither of the two groups showed any relationship with spatial or perceptual-motor skills represented by WISC Factor 4. In correlating this DEPVAR factor with IQs we find support for the hypothesis in the high Group 1 relationship with Performance IQ.

However this finding is likewise not replicated in Group 2.

Hypothesis 2 would suggest that the Female-Language factor should correlate higher with verbal factor or IQ scores than with perceptual-motor, spatial, or numerical type of abilities. There is some replication in terms of higher correlations for the Verbal-Symbolic WISC factor and lower relationships for the Perceptual-Motor-Spatial factor. Group 1's substantial negative correlation with WISC Factor 4 supports Vernon's (1965a) findings while the high positive relationship in Group 2 with the Verbal-Symbolic factor adds to Bernstein's (1961) results. The Group 1 DEPVAR Factor 4 score correlations with the IQ scores, all being zero, contribute to neither past research nor to the hypothesis. Group 2 on the other hand provides good support

in terms of a high relationship with the Verbal IQ and with the Full IQ. The Full IQ correlation supports Bernstein's (1961) statement that homes with "formal" language not only perform well on verbal tasks but also score high on overall intelligence.

The Canonical correlation coefficients, instead of providing specific relationships among the various measures of environmental characteristics and different types of abilities, provided an estimate of the relationship between two sets of differential scores considered simultaneously. These results do not enter directly into any of the hypotheses but they do indicate that there is a substantial relationship between information from the DEPVAR home environment scale and mental ability measures.

In summing up the discussion for Hypothesis 2 there are two points that should be mentioned. One of the points is the difference in interpretation of the results using variable and subtest scores, and using factor scores. Although the factors seem to summarize the relationships it appears that in many instances the variable relationships are much clearer. Undoubtedly some of the lack of clarity in the factor score relationships may be the result of some uncertainty in interpreting the factors. However, it must be remembered that one of the objectives of this study was to examine more than one DEPVAR variable simultaneously as they relate to different mental abilities. The frequent

relationship of certain DEPVAR variable scores or DEPVAR factor scores to an overall ability is also of interest. Because the emphasis in this study was on differential measures there was minimal hypothesizing of relationships between environmental characteristics and overall intelligence. Any such relationships of any significance have been pointed out despite the fact that they have not been included in the hypotheses.

Hypothesis 3. The results have indicated that there must be some aspects of the DEPVAR scale that covary with the Blishen socio-economic index. The T^2 statistic showed for both Groups 1 and 2, that when all ten DEPVAR variables were considered simultaneously there were significant differences in scores for the High SES and Low SES samples. The results for the individual comparison showed that the scores between the two socio-economic samples differ significantly at the 0.10 level for Variable 1 (Aspirations and Expectations) in Group 2 and Variables 1 and 3 (Opportunity for Language Development) in Group 12. This would suggest that DEPVAR Variable 1 might be particularly influential in producing the significant overall differences between the scores for the two socio-economic samples. On examining the specific DEPVAR Interview Schedule questions we might assume that variables such as 1 and 3 probably have some features in common with the conventional socio-economic characteristics. Other

DEPVAR variables that showed reduced probabilities of chance differences but were still far from reaching the selected levels were 4, 8, and 9 (Language Model; Authoritarianism; Environmental Interaction). Individual variables which show least difference between the High and Low socio-economic samples might also be of interest since they may represent those aspects of the environment which are quite different from the conventional socio-economic index characteristics.

Hypothesis 4. This is an exploratory hypothesis which hypothesized that the relationships between DEPVAR variable scores and Full IQ scores will be different for the High and the Low socio-economic samples. Although there seemed to be numerous differences for Groups 1 and 2 between the correlation coefficients for the two socio-economic samples, the only replication that occurred was for Variables 7 and 8 (Dependency-Overprotection; Authoritarianism). There was a distinct reversal of differences between Groups 1 and 2 for Variables 1, 2, 3, 4, 5, and 9 (Aspirations and Expectations; Knowledge of Child's Development; Opportunity for Language Development; Language Model; Female Dominance; Environmental Interaction). Such results may suggest that there are relational differences between the High SES and Low SES samples however the findings do not allow any conclusions to be made as to the directions of the differences. An interesting trend revealed in Table 30 is that generally,

the High sample in Group 1 has higher correlations whereas the Low sample in Group 2 shows better relationships. The results of the DEPVAR factor score and Full IQ score comparison parallel the DEPVAR variable score findings.

CONCLUSIONS

Hypothesis 1. The Differential Environmental Process Variable Scale. The following points support Hypothesis 1: (i) Valid a priori categorization of items into variables was shown by an item factor analysis, (ii) satisfactory inter-rater reliabilities ranging from 0.817 to 0.917 were obtained, (iii) the reliability of the instrument was confirmed by replicable variable inter-correlations and factor analysis results, (iv) the differential quality of the instrument was shown by replicable, low intervariable correlations and by factor analyses results which were suitable for meaningful factor interpretation, (v) validity of the variables: on the basis of replicated hypothesized relationships Variables 1, 2, 3, 5, 7, and 8 were classified with considerable confidence as being valid, Variable 4 as being valid with

limited confidence, and Variables 6, 9, and 10 as requiring re-examination in terms of what they may actually be measuring.

Hypothesis 2. Relationships between DEPVAR environmental characteristics and WISC mental abilities.

Part a. With the exception of DEPVAR Variable 4 (Language Model), whose results did not replicate, this part of Hypothesis 2 was upheld indicating that environmental characteristics in the home where parents had high aspirations and expectations and knew about their children's academic development, and where there was ample opportunity for language development correlated positively with verbal and academic types of abilities. In addition several consistent unhypothesized relationships between these environmental variables and overall ability emerged.

Part b. This part of Hypothesis 2 was confirmed, pointing out that female dominance characteristics in the home will have lower correlations with spatial, numerical, and reasoning types of abilities than with verbal ones. The supplementary finding that this environmental characteristic relates negatively to practically all abilities was not

hypothesized.

Part c. Support for this part of the hypothesis was lacking. In contrast to the hypothesized relationship, it was found that planfulness, purposefulness, and harmony in the home related higher to verbal types of abilities than to numerical and reasoning ones.

Part d. This part of the hypothesis was upheld by the results which indicated that an over-protective, dependency-fostering home environment had low correlations with reasoning abilities, both verbal and non-verbal ones. However replication was lacking to add support in terms of the hypothesized outcome that this environmental variable will correlate lower with spatial and numerical abilities than with verbal abilities. In addition, unhypothesized negative relationships between this variable and essentially all the mental abilities were strongly brought out.

Part e. This part of Hypothesis 2 which stated that an authoritarian home environment will relate less to spatial, perceptual, numerical, and reasoning types of abilities than to verbal abilities was confirmed. The consistent

unhypothesized negative correlations between this environmental variable and practically all the mental abilities was an additional finding.

Part f. Lack of support for this part of the hypothesis was mainly the result of very different findings for the two groups. Although one of the groups supported the hypothesis that extensive interaction with the environment relates higher with non-verbal, spatial, and reasoning types of abilities than with verbal ones the other group's results show the opposite relationships.

Part g. This part of the hypothesis was not upheld. The results showed that home environments where there is emphasis on, and opportunity to, initiate and complete tasks related higher to verbal and academic abilities than to numerical and reasoning abilities as was hypothesized.

Hypothesis 3. This hypothesis, which stated that the scores on the different environmental variables would differ for persons from High than for persons from Low socio-economic status levels, was confirmed. Replicable significant differences in scores were found when all ten environmental variables were considered simultaneously.

Hypothesis 4. As a result of limited replication, this hypothesis, which proposed that relationships between different environmental variables and overall intelligence would be different for persons from High than for persons from Low socio-economic status levels, was considered to be only partially confirmed. Replicated support occurred only for the overprotective-dependency fostering and authoritarian variables. Distinct differences appeared between relationships of the High and the Low socio-economic samples for many other variables however the differences were not in the same direction for both groups.

IMPLICATIONS

Significance

Theoretical. One of the important implications of a study such as this is its contribution to the theoretical aspects of measuring environments and relating them to human characteristics. Much of the work that has been done in evaluating environments was in terms of gross socio-economic types of characteristics which are static and often only symptoms of the environment. The socio-economic

indices do not indicate what really goes on in the home and it is only through implication that we presume that certain types of behaviors and activities correspond to certain socio-economic levels.

This project belongs to a group of studies which focus on the dynamic characteristics in the home. It attends to the activities in the home which act as presses in the development and maintenance of certain human characteristics. By evaluating the dynamic aspects in terms of what the family actually does, a differential measure of the home environment was obtained. It is hoped that measures such as the DEPVAR which identify environments in terms of ten variables or about four underlying factors will enable educators and psychologists to diagnose the home environments.

Establishing relationships between environmental characteristics and human traits, as in this case intelligence, may lead to a discovery of the antecedents of intelligence. This would provide a better understanding and formulation of the interactive process between the environment and heredity. It should also give a clearer concept of the relative potency of different environmental characteristics on the development of different aspects of human intelligence. It may be that certain authoritarian characteristics in the home may be beneficial if they are in a home which is high on the Opportunity for Language

Development variable (DEPVAR 3). This study also suggests that activity is a home environment characteristic which is related to overall mental ability. Activity in "any shape or form" in the home might therefore be the underlying antecedent of mental ability.

Since in the development of intelligence the heredity aspect is basically uncontrollable, we should focus on maximizing the influences of environments, which can, to a large extent be controlled, towards the development of desirable characteristics. We should however examine carefully which human characteristics are desirable for the society and satisfying to the individual. We should be aware of what the consequences of maximizing the development of certain characteristics would be.

The development of some of these human characteristics through controlled and potent environments must also be viewed in the context of pay-off since many of the environments would be expensive to develop and maintain.

Many of the above implications will require additional research and more empirical evidence to develop new theories or modify existing ones. However there are a number of considerations in terms of the practical application of the results of this study.

Practical application. In proposing the following applications of the results of this study we are assuming

that decisions have been made as to what the desirable and personally satisfying characteristics are that we wish to develop and maintain. While proposing the implementation of some of the findings in the field it must still be remembered that the relationships obtained in the study are merely correlational and not necessarily causal.

Knowledge of the home environments of individuals or groups of people would assist in modifying or setting up new curricula especially adapted to students with particular backgrounds and home environments. Certain teaching techniques could be arranged and instructional materials provided, depending on the home environment of the children. Prior knowledge of the child's environment would facilitate more accurate placement of the students in different programs, subjects, or classrooms. If we are willing to accept the child's development up to this point as being adequate, knowing the home environment, we would provide him with curricula in which he can have most success. However, again having good knowledge of the child's environment, if we find that he is, for example, low in verbal abilities or perceptual and spatial abilities and we wish to strengthen these skills we could modify the school environment in such a way that the language development opportunities increase, or that the child can encounter more kinaesthetic and visual experiences respectively to

improve these underdeveloped abilities. Having information about the environment and knowing the relationships between environments and human characteristics, the school can lead to the development of individual educational prescriptions for students.

The majority of predictions of academic or intellectual development have been based on predictors which were merely some previous academic or intellectual performance. Research has shown that other information such as personality characteristics, socio-economic scores, and even attitudes help predict how a person will be able to perform in the future. Wolf's (1964) study as well as Bloom's (1964) work are excellent examples showing that knowledge of environments can contribute greatly to predicting a child's performance. Results of the environmental assessments and the relationships obtained in a study such as this one can be used not only to help explain certain levels of performance by children, but also to improve prediction of intellectual development. Many of the environment-mental ability intercorrelations were not high enough to be used as individual predictors, however, the environmental measures may be quite useful when used in conjunction with other predictors. Although it is difficult to point out which DEPVAR variables might be most effective in combination with other predictors in a battery until they have all been used together, the

writer would advocate the use of DEPVAR Variables 1, 3, and 9 (Aspirations and Expectations; Opportunity for Language Development; Environmental Interaction) in predicting mental ability and particularly the verbal abilities. DEPVAR Variable 8 (Authoritarianism) would be useful in combination with other variables or tests in predicting non-verbal types of abilities.

Deficiencies that exist in the characteristics of a child may be the result of a particular type of home environment. If the school or community can diagnose this to be the case, compensatory or supplementary environmental situations may be created in the educational setting to try to eliminate these deficiencies. Working in conjunction with parents, "powerful" environments could be established. A "powerful" environment is one which will maximize the development of a particular human characteristic and only very few individuals will be able to resist the effects of such an environment. In addition to creating these environments in the educational setting, the home environments could likewise be modified. Some characteristics such as parental aspirations and expectations may be difficult to incorporate or implement in the home regardless of how cooperative the parents may be. However, most parents or families would be helpful and would be amenable to making their home situations more desirable with respect to opportunities for language development

(DEPVAR 3), opportunity to interact with the physical environment (DEPVAR 9) and opportunity for developing independent behavior by the child (DEPVAR 7). These environments would be even more effective if knowledge of the impoverished environment were known early and the powerful environment would be applied at the critical time for the development of the particular characteristics.

Another area where the application of the results of this study could be used is in the education of parents. Caution should be exercised, however, to ensure that the introduction of such information into the home is not mechanical or artificial. Such information would be artificial if it were not preceded by extensive sessions with the parents where thorough understanding would be acquired in the areas of child behavior and developmental psychology. A mechanical or artificial approach would undoubtedly produce very limited or at the most superficial effects. Presenting the environment-mental ability relationships to the parents by incorporating them in the context of some comprehensive programs of parent education or family living would be more effective. The findings from this study would emphasize the strengthening of the intellectual climate of the home by suggesting the incorporation of characteristics represented by DEPVAR Variables 1, 2, 3, and 9 (Aspirations and Expectations; Knowledge of Child's Academic Development; Opportunity for

Language Development) and de-emphasizing those features connoted by DEPVAR Variables 5, 7, and 8 (Female Dominance; Dependency-Overprotection; Authoritarianism). This in turn would facilitate the intellectual development of the children.

Implications for Further Research

The uncontrolled or confounding variables in a basically exploratory study such as this one make it difficult to assume findings as conclusive or relationships as causal. The replication in the study did allow a certain amount of confidence to be placed in the results which were consistent over the two groups, nevertheless, additional research both specific and general is one of the logical implications of this project.

Probably one of the more interesting pursuits would be further work on the DEPVAR interview schedule. Examination of additional schedules or questionnaires that purport to measure environments and the associated theoretical bases for these would be one way of refining the instrument. Studies using the DEPVAR with different groups and subjecting the results to a more detailed analysis would contribute additional empirical evidence for modifying or improving the schedule. Further attempts at construct validation of the environmental variables should be made. More detailed studies with the DEPVAR

could provide insight into some of the interaction or moderator effects of the different environmental variables. For example the authoritarian variable or characteristic in combination with high aspirations and expectations characteristics could have very different relationships with mental ability than if it were combined with a home environment characteristic such as opportunity for language development. It was found for instance, that authoritarian and overprotective characteristics in the home related differently with overall ability for the High than for the Low socio-economic samples. It may be interesting to study the relationships between these environmental characteristics and different types of mental abilities within different socio-economic categories. Such studies could also find that some environmental variable(s) could act as a moderator (Saunders, 1967). Classifying subjects according to this moderator variable makes it possible to obtain better relationships for certain groups of people among other variables.

Some suggestions for specific research on particular variables is in order. For instance the mother's Language Model (Variable 4) showed high relationship with ability for one group but essentially zero correlation for the other group. Assuming that the theoretical basis for evaluating this variable is sound it would be worthwhile finding out how the variable would

stand up in other samples. A theoretical reformulation may have to be made for Variable 6 (Planfulness, Purposefulness, Harmony) on the basis of the resemblance of its activities or processes to those of Variables 1, 2, and 3 (Aspirations and Expectations; Knowledge of Child's Development; Opportunity for Language Development) as implied by the factor analyses and the similar relationships with the various mental abilities. An investigation of what it is about Variables 9 and 10 (Environmental Interaction; Completing Tasks) which seems to differ from Variables 1, 2, and 3 according to the factor analysis but yet relate similarly to the mental abilities, may clarify the validity of the two variables. In addition to studying some of these variables in more detail, all of the variables or relationships could be examined in terms of the effect that parent education and the use of languages other than English have on the environmental variable scores and on the relationships.

Relationships of the type suggested in Hypothesis 3 should be more fully investigated. In addition to finding out that the environmental variable scores, considered collectively, differ for the High and the Low socioeconomic status groups, hypothesizing and testing to determine which individual variables contribute most and least to the overall differences is proposed. Knowing which variables contribute most would suggest which environ-

mental variables covary best with the socio-economic status scores. On the other hand, knowledge of which contribute least might contribute even more for here we would have measures of environment which are different from or independent of what the SES measures.

Implications for further research in a more general sense include designing studies where different approaches or methods of evaluating environments would be used. Instead of getting information about the environment from the mother only, other persons such as the child, the father, or other members of the home could be approached. There could be methods other than the interview for examining the home environment. More unobtrusive measures such as closed-circuit TV camera observations or more "projective" types of interview questions may give more valid information about the situation in the home.

Bearing in mind the cost and continuing cooperation required, probably the best approach to studying environments is through longitudinal studies. The assessment of the behavior directly obviates much of the error involved in obtaining information through recall and as perceived by different parents. The stability or pervasiveness of the environmental characteristics can be examined by this method. The writer's study assumed that the ten variables measured were stable for the period for which the activities and behavior in the home were investigated. Another approach

that would be less expensive but still provide some developmental sequence is the cross-sectional study applied at different stages of development.

This study was performed with Grade 4 (approximately 10-year old) boys. Research of a similar nature could be undertaken for different age levels as well as for different sexes. If the design of these additional studies were similar to that of the writer's certain theoretical and procedural reformulations would have to be made with regard to: (a) the interview schedule items, (b) the interpretation of the variables, and (c) who should be interviewed.

Probably the ultimate objective in the studies of environments and the development of human traits is to be able to establish causal relationships. Exploratory studies such as this one and many others performed in this area merely provide us with correlations between two or more characteristics, events, traits, or variables. Because of the nature of the variables measured, it is difficult to structure controlled experimental studies to be able to obtain cause-effect relationships. It is hoped that studies such as the present one will, provide us with findings in which we can place considerable confidence, and will lead us to undertaking research of the longitudinal nature where as many variables as is desirable are controlled and at the same time no individual will have his

development restricted as a result of experimental
research controls.

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A P P E N D I X A

DIFFERENTIAL ENVIRONMENTAL PROCESS VARIABLES

INTERVIEW SCHEDULE

NOTE: Begin each question by stating the question number (not the sub-sections).

- 1.(a) What marks do you expect your boy to make in school?
(b) What marks would you like him to make?
- 2.(a) How much schooling do you wish your boy to receive?
(b) What is the least amount of education that you think he should have?
- 3.(a) Have you made any plans to finance your boy's schooling beyond high school?
(b) Have you made any other plans about his higher education?
What are they?
- 4.(a) Is your boy taking training in activities such as music, dancing, art, swimming or anything else outside the regular school program?
(b) Which ones is he taking?
- 5.(a) What type of work would you like your boy to do when he grows up?
Generally?
Specifically?
(b) What type of work would you not like him to do?
Generally?
Specifically?
(c) How would you feel about your boy getting a permanent job immediately after completion of Grade 9?

Might it be possible to make a successful career out of the job that he would get with a Grade 9 education?
- 6.(a) What subjects does your child take in school?
(b) What marks did he receive in the different subjects in the last report?

(c) Which was his strongest subject?

His weakest?

7.(a) What specific questions do you ask your boy about his school work?

(b) How many times have you asked him about his school performance during the last two weeks?

8.(a) Does your husband ask your boy questions about school?

(b) What kinds of questions does he ask the boy?

(c) How many times has your husband asked him in the last two weeks?

9.(a) In which subjects do you think that he is working up to his ability level?

(b) Do you think that his report card marks represent his abilities correctly or can he do better than his marks show?

Why?

10.(a) Did the teacher, you or your husband make any comments on the last report card?

Who did?

(b) What were the comments?

11.(a) What is your boy's home room teacher's name?

(b) Have you met this teacher?

(c) Does your boy have any other teachers?

If yes, what are their names?

(d) Did you or your husband attend the last "meet the teachers" or home and school night?

When was this?

If not, when was the last time you or your husband were at school?

- 12.(a) Which magazines and newspapers do you subscribe or buy regularly?
- (b) Which ones does the boy read?
- (c) Which ones do you encourage him to read?
- (d) What kinds of books do you encourage him to read?
- (e) What were his last books from the public or school library about?

13. Do you encourage or request your boy to write letters or thank-you notes (for presents) and invitations (for parties)?

If yes, what were some specific instances in the last year?

- 14.(a) How many hours of T.V. does your boy watch per day (week day)?
- (b) What are his favorite programs?
- (c) Which particular T.V. programs did you recommend for your boy in the last month?
- (d) Which ones do you not like him to watch?

Why?

- 15.(a) Do you have a dictionary or any reference books at home?

Which dictionary?

Reference books?

- (b) Did you use the dictionary during the last month?
- If you did, how many times?

- (c) Did you use the reference books during the last month?
- How many times?

- (d) How many times has your husband used the dictionary in the last month?
 - (e) How many times a month does your child use the dictionary?
 - (f) How often does the boy use the reference books?
- 16.(a) Does your child have a public library card?
- (b) How often did he go to the library during the last two months?
- During an average two months?
- 17.(a) Does your boy bring reading books home from school?
- (b) How many did he bring during the last two weeks?
- 18.(a) Did you read to your boy during his preschool years?
- (b) What were some of the most read materials?
- (c) Does your boy read to you or your husband?
- Did he when he was about 6 years old?
- (d) Does your boy tell you or your husband about the stories that he reads?
- (e) Does he tell you or your husband about the movies or T.V. that he sees or about any of his out-of-home activities?
- (f) Do you usually have time to listen to his descriptions?
- 19.(a) Is the whole family present for the entire evening meal?
- If not, what is the situation?
- How long has it been this way?
- What was the situation before?
- (b) How do the meals go?

Are they quiet or noisy?

Could you elaborate a little?

(c) Does everyone have a chance to talk at the table?

(d) Is the radio or T.V. on during the evening meal?

Which?

20.(a) What events or activities do you have on week days or week-ends where the whole family takes part?

In summer?

In winter?

Both?

(b) Do you have any word games or do you play any games (matches) which involve new words or considerable reading, speaking or spelling?

What are they?

(c) Does your boy take part in any public speaking competitions, concerts (recitations) or plays (drama)?

If yes, could you name some specific instances?

(d) Do you as a family attend concerts, plays or movies?

If you do how many times have you attended in the last year?

21.(a) About what types of things does your boy ask questions most frequently (how things work, why people do certain things, how you do things, directions, permission)?

(b) Are the questions usually of the straight-forward short answer type or do they require detailed explanations?

22. Do you feel that high ability in speaking, writing and reading is:

absolutely essential _____.

is useful _____.

or is not really necessary _____ for success in life?

- 23.(a) Does your boy enjoy talking to and discussing things with adults other than his parents?
- (b) What opportunities are available for him to talk to other adults?
- (c) Do you encourage him to talk and discuss things with other adults?

In what particular way do you encourage him?

- 24.(a) At what time does your husband go to work?

What time does he come home?

Is this his schedule for every day of the week?

- (b) Does he have a part-time job in addition to his regular job?

If yes, how many hours a week does part-time job take?

- 25.(a) How much time did your husband spend with the children after supper during the last week (average per day)?

What is the average amount throughout the year?

- (b) How much time did your husband spend with the boy during the last two week-ends?

During an average two weeks? What did they do?

- (c) What are some of your husband's activities during week-ends which take a large portion of his time and do not include the boy?

- (d) Do you sense that the boy would like to do things with your husband more than he presently does?

- 26.(a) Do you feel that, to a certain extent, the situation at home may be one where you "handle the kids" while the husband attends to the other affairs?

- (b) If not, then who usually has the final word with respect to the children's privileges and activities?

- (c) Do you feel that you would like your husband to be more involved in bringing up the children?

In what ways?

- 27.(a) Is it you or is it your husband that usually "discipline" the boy?
- (b) When does your husband usually enter in to "discipline" the boy? (certain types of situations).
- 28.(a) Who usually suggests that the children take out-of-school classes or activities?
- Who makes the arrangements for these?
- (b) Does your husband listen or watch the boy practice some of these activities (piano, hockey)?
- Which activities?
- (c) Who watches or listens to him more, you or your husband?
- 29.(a) If your child has some problems with respect to school, who usually settles the matter, you or your husband?
- Why not; / you / or / your husband /?
- (b) Who arranges appointments and goes to talk with the child's teacher or the principal?
- (c) If your child has some problems with respect to the neighbors or other children who usually settles the matter, you or your husband?
- Why not: / you / or / your husband /?
- 30.(a) When you put on a party or a social event do you find that the ones arranged "on-the-spur-of-the-moment" or those which are planned well in advance are most successful?
- (b) Who usually does the planning or deciding for these parties or social events, you, your husband?

- 31.(a) How often in the last two months did you have family "get-togethers" with your friends or relatives which included the children?

How often during any average two month period during the year?

- (b) Do you together as a family go to watch or take part in any sports?

- 32.(a) How often have you and your husband gone out together in the last two months?

During an average two month period?

- (b) How often in the last month has your husband attended evening functions without you?

What types of functions were these?

- (c) What types of activities do you attend without your husband?

How often did you go in the last two months?

- (d) Do you and your husband encourage each others individual activities?

- 33.(a) Do you have a definite budget in the home?

- (b) Do you and your husband have specific discussions with respect to buying appliances, cars, property?

- (c) What are some specific examples of purchases that each makes "on his own" without consulting the other?

How do you or does your husband feel about these types of purchases?

- 34.(a) Do you and your husband use somewhat different basic "disciplinary" methods in bringing up children?

- (b) Can you think of some specific instances in the last month where you would have used different techniques from those that your husband used?

- (c) If some of your methods differ do you feel that they still fit together well in your home?

- (d) Does one parent occasionally "side" with the child in conflicts which involve him?

How often has this happened in the last two weeks?

- 35.(a) Are there any parts on your appliances that have not been working for a long time and have not been repaired?

Why have they (it) not been repaired?

- (b) How many times in the last year has your car broken down to the point where you could not use it?

- 36.(a) Did you find that your child's preschool years you frequently had to settle arguments or fights and restore order among the neighborhood youngsters?

- (b) Did you frequently join in play with the children in their preschool years?

Was this to guide them or to keep order?

- (c) In the children's preschool years did you frequently observe your own and neighborhood children in play?

What was your main purpose in observing them?

- (d) Do you think that children, in their preschool years, playing with other boys and girls, always require adult supervision or should they be left to solve their own problems and do their own planning?

- 37.(a) Did your boy, in his preschool years play more in his own yard or at the neighbors?

Which did you prefer him to do?

Why?

- (b) Did you make arrangements and provide facilities in your home or yard which encouraged your boy and his friends to play at your place rather than elsewhere?

What special arrangements did you make or facilities did you have?

- (c) Were there, or are there still any youngsters in the neighborhood with whom you felt your boy should not play?

Why did (do) you not approve?

- 38.(a) Where did you keep things such as scissors, knives and other sharp objects when the boy was young?

Were these special places?

Are the articles still kept there?

- (b) Did you caution or warn him regularly about stairways, stoves, knives, traffic, strangers and other dangerous objects and situations?

- 39.(a) At what age did you permit your boy to take his bicycle to school, to the local store?

- (b) At what age did the boy go to the community playground with other children?

- (c) At what age did you allow your boy to go to friends, relatives or camp for periods of more than two whole days? (excluding times when you had to be separated from him).

- (d) At what age did you allow him to go on hikes along the river or on treasure hunts with other boys?

- (e) Does he go down town alone (without parents or older brothers or sisters)?

At what age did he start?

- 40.(a) What action do you take when your boy tells "dirty" stories or uses swear words which he picked up in the neighborhood playground or at school (now and in his preschool days)?

- (b) What do you or would you do if you noticed him reading magazines or books with "dirty" stories or swear words?

- (c) Do you have any books in the home which you do not wish your boy to read?

What are they?

Why do you not wish him to read them?

- (d) Did you have any books that he was not allowed to read when he was younger?

What were they?

Why did you not wish him to read them?

- (e) Did you approve of your boy watching horror or mystery movies when he was very young? (preschool years).

- 41.(a) If you or your husband buy your boy a shirt, or some other clothing and he does not like it do you take it back or do you usually convince him to keep it?

- (b) How is the decision made as to which clothes the boy wears to school every day?

- (c) How was this decided two years ago?

- 42.(a) What are some specific tasks that he wishes to do but you feel that he would not do well enough because he is too young?

- (b) What are some tasks that he should be doing well but he still doesn't?

- (c) Do you let him try them regardless or do you usually do them for him?

- 43.(a) Does your boy get an allowance?

- (b) If not, does he get any spending money?

- (c) What is he permitted to spend this money or allowance on?

- (d) If his money or allowance runs out what happens then?

- 44.(a) Does your boy "talk back" to you or your husband?

If not, why do you think that he doesn't?

- (b) What do you or your husband do if your child does "talk back" to you?

- (c) What do you do if your child interrupts your conversation with other adults?
- 45.(a) What specific rules did you and do you have for your boy with respect to:
- (i) bedtime,
 - (ii) mealtime,
 - (iii) T.V.,
 - (iv) church,
 - (v) visiting?
- (b) How much say does he have in setting these rules?
- (c) Are the rules always enforced?
- (d) Would you say that these rules are generally for bringing out adult behavior in your child?
- (e) What other purposes do you have for setting the rules?
- 46.(a) What do you do when the rules that you set are not obeyed?
- (b) If your boy repeatedly does not do some tasks or chores well how do you punish him?
- (c) When was the last time your boy had physical punishment?
- What was it for?
- 47.(a) Do you feel that your child really worries when he has done something wrong?
- Why does he worry?
- 48.(a) Do you or your husband "give in" to requests by your child which are contrary to your rules?
- (b) What are some examples of such instances?
- 49.(a) What were some of your boy's hobbies or keen interests in the last three years?

(b) What is his present hobby (ies)?

How much time has he spent on it in the last two weeks?

1 hr. - 2 hrs. - 5 hrs. - 10 hrs.

How much time during an average two week period?

50.(a) What are your husband's hobbies or specific leisure activities?

(b) In what projects or sports do your husband and boy participate together? (includes e.g. building fence, painting).

(c) Is your boy interested in any of your hobbies or leisure activities?

Which ones?

51.(a) Would you say that during the boy's preschool years you bought toys for him "too soon", that is, before he really knew what to do with them?

(b) If yes, how did you feel if he didn't "take to them" at that time?

(c) Did you get him toys at any time of the year or just for special occasions?

(d) What types of gifts did he get for Christmas or birthdays when he was about 4 - 5 years old?

(e) What did he get for the last two birthdays and Christmases?

52.(a) In the last year how many times has your boy gone fishing, hunting or on tours?

(b) How often has he gone hiking or camping in the last year?

How many days did he spend on such activities during the year?

(c) Does your boy play any sports regularly?

If yes, which?

53.(a) Can you recall how old your boy was when he was allowed to use certain specific appliances such as the vacuum cleaner or record player?

Other appliances?

(b) Which of your husband's tools or machines is he permitted to use?

(c) Which tools or appliances is he not permitted to use?

54.(a) Would your boy rather read books or write or does he prefer spending his time with sports, hikes, building or repairing things?

(b) Do you believe that a physically normal person can be successful in life without being capable in the use of speech, reading or writing provided he works hard and is handy with tools and machines?

55.(a) Does your boy do puzzles (crossword, jigsaw, word, drawing, arithmetic) in the daily paper, in books or in magazines?

(b) What are some that he does?

(c) Does he usually complete the ones that he starts?

(d) Do you think that the puzzles should always be completed?

(e) Do you or your husband take any interest in such puzzles?

If yes, in what way?

56.(a) What specific projects (models, collections, new games) has your boy undertaken on his own in the last one or two years?

Which has he completed?

Has he dropped any before completion?

(b) What do you do about his unfinished projects?

(c) Do you encourage him to start new projects?

How?

- (d) How do you show your pleasure in projects that the boy completes well?

Do you reward him or praise him in any other way?

57. Does your boy prefer to plan organized games or is most of his activity spontaneous and varied?

- 58.(a) Do you assign regular chores or tasks for the boy?

- (b) After assigning them which chores is he expected to do regularly on his own without being reminded continually (e.g. clean room, brush teeth)?

Does he?

- (c) If he attends to and completes the tasks or chores without having to be reminded repeatedly what rewards, praise or payments does he get?

- 59.(a) Do you or your husband praise or reward your boy only if he completes the tasks, chores or projects?

- (b) Do you prefer that your boy attempt many projects or, that he just attempt a few but completes them?

- (c) What methods or techniques do you and your husband use to ensure that tasks are completed well by the boy?

Are they successful?

A P P E N D I X B

DIFFERENTIAL ENVIRONMENTAL PROCESS VARIABLES

RATING SCALES

1. ACADEMIC AND VOCATIONAL ASPIRATIONS AND EXPECTATIONS
OF PARENTS

7. Definite aspirations and expectations of high school and post-secondary school completion, followed by a professional career. Aspire and expect child to receive high marks throughout school years. Making definite preparation for financing education and exploring occupations.

6.

5. Aspire and expect child to complete high school plus some post-secondary training then terminating in some semi-professional or technical vocation. Anticipate average marks.

4.

3. Aspirations and expectations set at completion of high school and entrance into some skill, trade or white collar occupation.

2.

1. No expectations about grades nor aspirations for completing any more than the legally required schooling. Aspirations for child are basically the acquisition of any type of a permanent job as soon as possible.

2. KNOWLEDGE OF, AND INTEREST IN, CHILD'S ACADEMIC
AND INTELLECTUAL DEVELOPMENT

7. Has detailed picture of child's academic and intellectual development. Knows his strengths, weakness, areas of difficulty. Is aware of child's progress in school. Parents have fairly accurate idea of what the child may be capable of doing. Information about the child obtained from school personnel, the child, report cards. Both parents are knowledgeable.

6.

5. Has general knowledge of child's development which is based primarily on school reports. Parents own personal appraisal of academic and intellectual development is minimal. Knowledge of child's strengths, weaknesses and intellectual level is general. Maintain contact with school personnel.

4.

3. Can only identify areas of strength and weakness from report card which is the sole source of information about the child's academic and intellectual development. Only one parent may show interest. No contact with school personnel.

2.

1. Although required to respond (signature) to the report card parent has no real conception of how child is performing in school. No knowledge or own idea about child's capabilities.

3. MATERIAL AND ORGANIZATIONAL OPPORTUNITIES FOR THE
USE AND DEVELOPMENT OF LANGUAGE

7. Abundance and extensive use of a variety of reading materials in the home. Wide use of community reading resources. Deliberate and consistent efforts made in the home to design situations for the development of language. Encouragement of the use of oral language in terms of speaking and listening. Conscious awareness of importance of linguistic competence.
- 6.
5. Attempts made to capitalize on normally occurring situations to promote language development. Some encouragement given to use of existing facilities in the home and the community (home books, radio and T.V. programs, concerts, libraries).
- 4.
3. Little effort made to use the natural situations to promote the use and development of language. Minimal verbal materials available in the home. No deliberate emphasis on the importance of language facility.
- 2.
1. No encouragement in the home to use language as a means of effective communication. Communication is curt and often non-verbal. No reading materials or facilities for language development available in the home. No encouragement to use community facilities. No awareness of the importance of linguistic competence.

4. QUALITY OF LANGUAGE IN THE HOME

Evidence of the quality of the language of the parents is based on the language performance of the mother during the course of the interview. The language model level will be determined by a measure of the number of words per communication unit in a sample of speech from the interview. The level will then be expressed in terms of the seven point rating scale below.

7. Excellent

6. Good

5. Above average

4. Average

3. Below average

2. Poor

1. Very poor

5. FEMALE DOMINANCE IN CHILD REARING

7. The mother handles all the affairs regarding child's disciplining, clothes, lessons, report card, school interviews. The father is not home most of the week. Father is not involved with child even when at home on week-ends, holidays (goes golfing, etc.). Attitude from father -- "You handle the kids."

6.

5. Mother handles most affairs of child. Father home more often. Gets involved in some of child's activities although indifferent to many of child's personal affairs. Never very personal with child.

4.

3. Father home regularly. Assists with some of child rearing activities. May discuss welfare of child with mother.

2.

1. Both parents attend to, discuss and share in the affairs of home with respect to the child. Father home daily. Devotes a considerable share of spare time with child. He inquires and is knowledgeable about child's school progress and any other aspects of child's development. Both parents feel a full responsibility in the child rearing process.

6. PLANFULNESS, PURPOSEFULNESS AND HARMONY IN THE HOME

7. Family has many activities as a unit. Considerable planning with respect to events, holidays, purchases, money. Children involved in some planning. Full agreement on child rearing (discipline, privileges, policy) practices which are similar for both parents.

6.

5. Some differences in outlook by parents with respect to child rearing, however these usually resolved as being complementary. One parent may do planning alone in a number of areas, however the family seems to agree to decisions.

4.

3. Occasional disagreements in the home on child rearing practices, finances, purchases. Very few family functions (sports, vacations, picnics, visits with friends). One parent absent during evenings, week-ends, however no disapproval from other parent.

2.

1. No group or family planning on any issues (e.g. no budgeting, especially when necessary). Constant disagreement with respect to child rearing. No organized family functions either alone or with friends. Considerable absence of one parent in the evenings (especially father attending activities such as card game, beer parlour). Usually other parent disapproves absence. Frequent verbal disagreements at home (occasionally physical).

7. DEPENDENCY FOSTERING - OVERPROTECTION

7. Unrelenting vigilance with respect to child's play and any other activities. Mother provides frequent moral or physical support for child in his confrontations with peers. Constant reference to potential dangers of environment (consistent cautiousness training). Always "doing things" for child. Refrain from asking child to do certain tasks because he cannot do them well enough.
- 6.
5. Aspects of environment still presented as potentially dangerous. Frequent reference to dangerous naturally occurring situations. Remind child about inadequacy of performance rather than not allowing the child to attempt certain tasks. Consideration given to some of child's decisions.
- 4.
3. Child's performance standards and expectations are kept at a level which is somewhat in line with child development. No structuring of safe situations however caution in the naturally occurring ones is exercised. Will often help child perform in new areas rather do tasks yourself.
- 2.
1. Allow child to try new activities or go to more distant and varied places at an early age (not unreasonably). Do not feel overly anxious when child is in a "foreign" place or attempting a new task. Encourage the child to "stand up for himself". Not concerned about over-exposure of the child to degrading or dangerous elements.

8. AUTHORITARIAN HOME

7. Rigid parental behavior demanding unreserved and undifferentiated obedience. Punishment (often physical) for behavior considered inappropriate (usually non-adult) by the parents. Both parents operate at this level. The child's comments or suggestions with respect to rules, privileges are not entertained by the parents. Aggression towards parents is forbidden. Rules are inflexible for varied situations or for different children. Child responds mainly as a result of fear.
- 6.
5. One parent only may be creating the majority of the authoritarian environment in the home. Obedience of a more differential nature is demanded although still based on power as part of the parental role.
- 4.
3. Obedience is a result of respect and understanding. Parents willing to involve the child in conversations involving planning and rule setting. Begin to accept child's imperfect non-adult behavior.
- 2.
1. Child does not fear parents and feels comfortable in asking questions, breaking into adult conversation of making suggestions. Child's feelings and comments are given consideration in appropriate contexts. Aggression toward parents as well as non-adult behavior are tolerated and accepted. Rules and standards are flexible although not inconsistent.

9. INTERACTION WITH PHYSICAL ENVIRONMENT (VISUAL AND KINAESTHETIC EXPERIENCES)

7. Good background in variety and sophistication of toys. Child has hobbies involving construction, manipulation. Considerable freedom in the early years as well as presently in the use of tools, appliances. Keen interest in things as opposed to reading per se and interpersonal involvement. Father or mother have some strong non-verbal interests.
- 6.
5. Involvement with peers was object- and environment-oriented, although not much encouragement from parents since neither parent has strong interests in interacting with environment (outdoors) or working with tools and objects. Good background of toys. Early use of numerous appliances.
- 4.
3. The interaction with peers did not involve much activity dealing with objects and exploration of the environment. Hobbies were low on visual and kinaesthetic experiences (collections, stamp, maps). Minimal use of appliances and tools.
- 2.
1. No opportunity to build things nor access to tools or materials. No participation with nor encouragement from the parents in interacting with the physical environment. No toys available -- most time spent with peers or parents in personal interaction. Presently prefers reading as opposed to hobbies which require handling materials, interpreting diagrams and putting things together.

10. OPPORTUNITY FOR, AND EMPHASIS ON, INITIATING AND CARRYING THROUGH TASKS

7. Child initiates and completes numerous tasks at home (extra-curricular, chores). The home environment is such that completing tasks and not just attempting them provides rewards (praise, other rewards).

6.

5. No deliberate efforts made to reward initiating and completing of tasks although certainly encouraged. Child does attempt and complete activities on his own however these are primarily in areas of extra-curricular (puzzles, hobbies) rather than also in necessary chores around the home.

4.

3. Minimal self-initiated activities or hobbies attempted by child. Parents may request things to be done but do not show much concern about how they are done or whether they are completed.

2.

1. No effort made in the home to encourage initiation and completion of tasks. Nothing definite in terms of tasks or chores requested or expected of child. Ad lib attitude towards many activities with no emphasis on carrying anything through to its completion.

A P P E N D I X C

DEPVAR SUB-ITEM SCORING KEY

Based on the Range of Responses for the
100 Subjects in this Study

1	2	3	4	5	6	7
1. 1a	no definite expect.	C	B		A	H
b	no definite aspirat.	B		A		H
2a	no wish Gr. 12		any post high training			Tech. or Univ.
b	doesn't know Gr. 9		Gr. 12 any post high training			Tech. or Univ.
3a	None	Indep. wealthy		Savings		Insur. Plan (Yes)
b	None	Yes discussions			Visits to aspired jobs.	
4a	None		sports, cubs		music, lang. art, dancing	
5a	doesn't matter	boy will decide		clerical		professional
b	doesn't matter	hazardous			immoral, menial	
c	all right	conditional			dissapprove	
-	yes	conditional			no	
2. 6a	no recollect 2		5	7		9
b	no knowledge	general marks		some specific		all specific
c	no knowledge	knowledge of one			knowledge of both	
7a	no questions	general questions	5		specific and general questions	10
b	none					
8a,b	no questions	general questions	2		general and specific questions	5
c	none					
9a	doesn't know	commitment			commitment and reason	
b	doesn't know	commit. & "He's capable"			commit. & explanatory reasons	
10a	no recollection	"I know he can" teacher			Teacher & parent or just parent (full recollect.)	
b	no recollection	(full recollect.)			descript. of one of comments	descript. of all comments
11a	no knowledge				knows name	
b	didn't meet	husband met, mother met			both met	
c	doesn't know				knows	
-	doesn't know				knows	
d	no				yes	
-	a year ago				within last month	

1	2	3	4	5	6	7
3. 12a	Better Pop. M., W. Cath, Life, True, McCalls, Edmon. J., MacL., Rd. Dig, Time H&G L.H.J.					
b	none	looks thru' some	looks thru' many			reads some
c	do not encourage	let him read what he wishes				encourage specific
d	do not encourage	let him read what he wishes				encourage specific
e	no knowledge	very general descript.				quite specific descrip.
13a	none	few thank-you-notes	many-t-y-n	few letters	many letters	
14a	less than 1/2	3/4		1	1	1 1/2 hrs.
	more than 4	3		2		
b	comics, gunfighters, crime, sports, sci. fiction, family, nature, educ. documentaries					
c	none	sports	comics,			Disney Nat. Geog.
d	no restrict.	horror	bad ideas			crime, war
-	nightmares					learn nothing
15a	no dictionary	small pocket				Oxford or Webster
-	no books	atlas				encycl.& other series
b	none			1	2	3
c	none			1	1	4
d	none			1	3	4
e	none		1	6		5
f	none	1	4	7		10
16a	no					10
b	none					yes
-	none			4		8
				2		4
17a	none	1		3		5
18ab	no		comics	Fairy Tales	Dr. Seuss	
c	no		sometimes			yes
-	no		sometimes			yes
d	no		sometimes			yes
e	no		sometimes			yes
f	no		try to have			definitely

1	2	3	4	5	6	7
19a no		part of time				always
b rigid rules, no talk		disorder noise				meaningful interaction of whole family
c no						yes
d yes always	frequently		occas. T.V.		low radio, no	
20a none	few indoor(non-group)			numerous indoor-outdoor	(4-5) (both sum. & winter)	
b none		bought games	bought & self-organized			
c none	simple routine (occas. class report, cubs)	1		school concert extra-ordinary (special group)	5	
d none				3		
21a permission, directions			variety			why people do certain things (how things work)
b short					both	detailed
22a not necessary			useful		absol. essential	
23a no			sometimes			yes
b no opport. or situat.			some	variety (visitors, relat, cubs, church)		
c no encourage - approve & allow discussion - request - organize and design situations						
5. 24a father home when child home		1/3 away	1/2 away	2/3 away	father always away when child home or awake	
(reg. job) b (5:00 on) (6:00 on)			5 hrs		10 hrs	
(away-from - no hrs/wk			no hrs/wk		10 hrs	
home job) -						
25a 3		2		1		none
- 2		1		1/2		none
b 16		8		4		none
- 16		8		4		none
- interaction activities						T.V.
c none					numerous (job, golf, social)	
d no			at times			yes

1	2	3	4	5	6	7
26a no			at times			yes
b father			both			mother
c not more involved			more time with children		as a male model	
27a father			both			mother
b many situations						none
28a father			both or children			mother
- father			both			mother
b yes						no
c father			both same			mother
29a father			both			mother
- mother doesn't want to			not avail.		father doesn't want to	
b father			both			mother
c father			both			mother
- mother doesn't want to			not avail.		father doesn't want to	
6. 30a spur-of-moment			either			planned
b father or mother						both
31a none	2			4		8
- none	2			4		8
b no			yes (one)		yes more than one	
32a		none		3		6
15	12			8		
- 15	12	none		3		6
b	12	12		8		
		none		1		3
	9			6		
stags, beer			sports		business, supper meetings	213
c out with girls (dance, beer)		none	sports, bridge		community service	
		9		1		3
12				6		
d no						yes

33a no of a type yes
 b no most of the time yes
 c one parent buys both buy neither
 disapprove approve

34a yes occasionally no
 b definite examples can't think of any
 d a few times once none

35a yes no
 - no times to fix or arrange to fix no parts
 b 3 2 1 none

7. 36a none occasional yes often
 b none just to play, enjoy self - guide - keep order
 c no, own pleasure, see how play, be certain they don't fight, be certain they are safe
 d no supervision some supervision always supervised

37a neighbors both own
 - neighbors either own
 - had more toys, brothers, sisters know where is, keep eye, safer
 b no yes-facilities yes-spec. arrangements
 c no bad influence yes
 - too old, too young, etc. unsafe

38a usual place, always there special place designed for child
 b sometimes yes emphatic always

39a 5 yrs 6 no 7 bicycle 8 9 greater than 10 yrs
 b 3 6 7 8 greater than 10 yrs
 c 3 6 7 8 greater than 10 yrs
 d 6 8 9 greater than 10 yrs
 e 8 10 not yet 214

40a explain, ignore, get angry, scold, punish
 b allow to read, take away, explain (tell he can read, get angry, scold, punish
 when older)

c no too young bad influence yes
 - wouldn't understand bad influence yes
 d no

- wouldn't understand
e yes

41a take back
b boy's own
c boy's own

42a no tasks
b no tasks
c let him do

43a yes
b yes
c anything he wishes
d gets more

too young
didn't matter

willing or convince to keep
boy's, mother check
boy's, mother check mother

one task
one task

irregularly
earns

must save some

bad influence
no

must keep
mother puts out

variety of tasks
variety of tasks
do for him

no
no

must ask
must wait

8. 44a yes
- knows he shouldn't -
b ignore
c explain, allow to interrupt

sometimes
always obeys - afraid of
punish.
cut privileges phys. punish.
ask to keep - get angry,
quiet and wait
until finished
many rigid, specific rules
none

45a few rules
b considerable
c seldom
d no expected child behav.
e child's welfare -

no
very little
usually
responsibility obedience
Charact. formation mother convenience
respect for obedience
parents -

yes
yes
absolute

46a tell again - explain - ground -
b make do again - explain - ground -
c never

anger, shout, threaten - phys. punish.
anger, shout, threaten - phys. punish.
can't remember recently (6 mos.)

1	2	3	4	5	6	7
47a no	guilty conscience bothers - afraid of scold, grounding - afraid phys. punish. yes					
48a often	occasionally never					
9. 49a low phys. and kinaesth. (rdg. T.V.)	phys. and kinaesth. rich (sports, building)					
b rdg., T.V.	1	2	2	5	5	10 hrs.
- none	5	2	2	1	1	none
- 10 hrs						
50a none sleep T.V.	rdg.					
b none				sports	chores	repairs crafts
c none				sports	sports	crafts
51a no	occasionally					
b anxious	kept them for later let him use regardless yes					
c special occasions	anytime					
d money clothes	books	pictures	games	trucks	blocks	construction
e money clothes	books	pictures	games	trucks	blocks	construction
52a none	1	2	5	10	25	10
b none	1	1	3	7	10	10
- none	1	1	3	7	10	10
c none	one summer or winter more than one summer & winter					
53a 9 yrs	8	7	6	5	4 yrs	4 yrs
b none	hammer		screwdriver	saw	axe	mower
c 5 articles			2 articles			none
54a read write			both	hikes	sports	build repair
b no			in some cases			yes

1	2	3	4	5	6	7
10. 55ab	none	class reqmt.	jigsaws	crossw.	Journal	crossw. J. & Spec. books
c	no		usually			yes
d	no		not always			yes
e	none		occas. self	occas. self & child	freq. self & children	
56a	none		1	2	4 things	
-	none		some		all	
-	yes				no	
b	throw away		nothing, put away, ask to finish, wait and have him do			
c	no way	ask him	buy him things		later, provide a variety of opport. to choose from	
d	verbal comment	reward (privil., monet.)	buy him more projects display			
57a	spont. & varied	both	organized			
58a	no		very few	3	yes	
b	none	2		4	5	
-	always requires reminding	sometimes	never			
c	no mention,	expected, weekly allow., parent checks, reward,	praise (verbal other)			
59a	no		for good honest effort		yes	
b	many	whatever boy wants	few & complete			
c	no particular definite methods		use numerous techniques			

A P P E N D I X D

INFORMATION SHEET

DISSERTATION PROJECT -- U. OF A.

HARRY MOSYCHUK

CASE NO. _____

1. NAME OF MOTHER _____

FATHER _____

BOY _____

2. DESCRIPTION OF FATHER'S OCCUPATION OR JOB _____

3. MOTHER'S EDUCATION _____

FATHER'S EDUCATION _____

4. NUMBER OF CHILDREN IN THE FAMILY _____

NUMBER OF CHILDREN OLDER THAN BOY _____

NUMBER OF CHILDREN YOUNGER THAN BOY _____

5. DOES ANYONE IN YOUR FAMILY (NOT GRANDPARENTS) READ OR
SPEAK IN ANY OTHER LANGUAGE THAN ENGLISH?

IF YES, WHO DOES? _____

IF YES, WHAT LANGUAGE(S) _____

A P P E N D I X E

DESIGNATIONS FOR ORIGINAL DATA FOR GROUPS 1 AND 2. THIS
INCLUDES BIOGRAPHICAL INFORMATION, SCALED WISC IQ AND
SUBTEST SCORES, AND RAW DEPVAR VARIABLE SCORES (Sheet 2)

Columns 1 - 3	--	Group and case identification (no decimals)
Columns 4 - 6	--	Socio-Economic Score (decimal between columns 5 and 6)
Columns 7 - 9	--	Age of boy (months) (no decimals)
Columns 10,11	--	Mother's education (years) (no decimals)
Columns 12,13	--	Father's education (years) (no decimals)
Column 14	--	Number of Children (no decimals)
Column 15	--	Birth order (no decimals)
Column 16	--	Foreign language spoken - mother (no decimals)
Column 17	--	Foreign language spoken - father (no decimals)
Column 18	--	Foreign language spoken - child (no decimals)
Columns 19,20	--	WISC Information Subtest (no decimals)
Columns 21,22	--	WISC Comprehension Subtest (no decimals)
Columns 23,24	--	WISC Arithmetic (no decimals)
Columns 25,26	--	WISC Similarities (no decimals)
Columns 27,28	--	WISC Vocabulary (no decimals)
Columns 29,30	--	WISC Digit Span (no decimals)
Columns 31,32	--	WISC Picture Completion (no decimals)
Columns 33,34	--	WISC Picture Arrangement (no decimals)
Columns 35,36	--	WISC Block Design (no decimals)
Columns 37,38	--	WISC Object Assembly (no decimals)
Columns 39,40	--	WISC Coding (no decimals)
Columns 41,42	--	WISC Mazes (no decimals)
Columns 43-45	--	WISC Verbal IQ (no decimals)
Columns 46-48	--	WISC Performance IQ (no decimals)
Columns 49-51	--	WISC Full Scale IQ (no decimals)
Columns 52,53	--	DEPVAR Variable 1 (see page 57 for verbal descriptions) (Decimal between columns 52 & 53)
Columns 54,55	--	DEPVAR Variable 2 (see page 57 for verbal descriptions) (Decimal between columns 54 & 55)
Columns 56,57	--	DEPVAR Variable 3 (see page 57 for verbal descriptions) (Decimal between columns 56 & 57)
Columns 58,59	--	DEPVAR Variable 4 (see page 57 for verbal descriptions) (Decimal between columns 58 & 59)
Columns 60,61	--	DEPVAR Variable 5 (see page 57 for verbal descriptions) (Decimal between columns 60 & 61)
Columns 62,63	--	DEPVAR Variable 6 (see page 57 for verbal descriptions) (Decimal between columns 62 & 63)
Columns 64,65	--	DEPVAR Variable 7 (see page 57 for verbal descriptions) (Decimal between columns 64 & 65)
Columns 66,67	--	DEPVAR Variable 8 (see page 57 for verbal descriptions) (Decimal between columns 66 & 67)
Columns 68,69	--	DEPVAR Variable 9 (see page 57 for verbal descriptions) (Decimal between columns 68 & 69)
Columns 70,71	--	DEPVAR Variable 10 (see page 57 for verbal descriptions) (Decimal between columns 70 & 71)

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